Summary of Non-Halibut Catch from the Standardized Stock Assessment Survey Conducted by the International Pacific Halibut Commission in British Columbia from May 27 to August 11, 2003

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SUMMARY OF NON-HALIBUT CATCH FROM THE STANDARDIZED STOCK ASSESSMENT SURVEY CONDUCTED BY THE INTERNATIONAL PACIFIC HALIBUT COMMISSION IN BRITISH COLUMBIA FROM MAY 27 TO AUGUST 11, 2003

by

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ABSTRACT

Yamanaka, K.L., Lochead, J.K., and Dykstra, C. 2004. Summary of non-halibut catch from the standardized stock assessment survey conducted by the International Pacific Halibut Commission in British Columbia from May 27 to August 11, 2003. Can. Tech. Rep. Fish. Aquat. Sci. 2535: iv + 53 p.

A third technician was deployed on the 2003 International Pacific Halibut Commission standardized stock assessment survey in British Columbia to determine species composition of the catch and to sample sablefish and rockfishes for biological information. These data are summarized and catch rates for redbanded (*Sebastes babcocki*), quillback (*S. maliger*) and yelloweye (*S. ruberrimus*) rockfishes are used to estimate input parameters for a simulation model. Simulations are then performed to determine the utility of the survey data as an index of abundance for rockfish.

RÉSUMÉ

Yamanaka, K.L., Lochead, J.K., and Dykstra, C. 2004. Summary of non-halibut catch from the standardized stock assessment survey conducted by the International Pacific Halibut Commission in British Columbia from May 27 to August 11, 2003. Can. Tech. Rep. Fish. Aquat. Sci. 2535: iv + 53 p.

Un troisième technicien a été affecté au recensement normalisé des stocks de la Colombie-Britannique (Commission internationale du flétan du Pacifique), afin de déterminer la composition des captures et de procéder à des échantillonnages biologiques de sébastes et de morues charbonnières. La synthèse des données biologiques et des données de capture recueillies sur les sébastes à bande rouge (*Sebastes babcocki*), les sébastes à dos épineux (*S. maliger*) et les sébastes aux yeux jaunes (*S. ruberrimus*) sert à établir les paramètres d'entrée pour un modèle de simulation. Des simulations sont ensuite effectuées pour déterminer l'utilité des données de recensement recueillies dans l'établissement de l'indice d'abondance des stocks.

1.0 INTRODUCTION

The International Pacific Halibut Commission's (IPHC) standardized stock assessment (SSA) survey was conducted in British Columbia waters (IPHC Regulatory Area 2B), from May 27 to August 11, 2003. This report summarizes the species composition of the total catch and the catch rate and biological sample data from rockfish and sablefish caught during this survey. The survey catch rate data are also assessed for their potential use as a relative abundance index for rockfishes.

The IPHC SSA survey is a fixed station survey that has been conducted annually, in Area 2B, since 1963 (www.iphc.washington.edu). It provides distribution, biomass, age, growth and maturity data that are used in the annual assessment of Pacific halibut (*Hippoglossus stenolepis*). In 2003, the IPHC provided the opportunity to deploy an additional technician to enumerate and identify catch to species on a hook by hook basis and to collect biological data, on sablefish and rockfishes, during the Area 2B survey operations (Appendix A). Financial support for the technician was shared among the Canadian Sablefish Association, the Pacific Halibut Management Association and the Department of Fisheries and Oceans (DFO).

The complete enumeration of non-halibut species during the SSA survey was performed in 1993 and 1995 in British Columbia. The identification of rockfishes improved on the SSA survey from 13% of occupied hooks recorded as "unidentified rockfish" in 1993 to 5% in 1995 (Kronlund, A.R. 2001 unpublished data). In 2003, complete hook by hook catch by species was recorded and for the first time, in Area 2B, biological sample data were collected at sea from the sablefish and rockfish catches.

2.0 METHODS

2.1 IPHC CHARTERED VESSELS

The *F/V Viking Joy* and *F/V Star Wars II* were chartered by the IPHC to conduct the Canadian portion (Area 2B) of the IPHC 2003 SSA survey. The *F/V Viking Joy* (CFV/VRN 29318) is a 62-foot, aluminium vessel, with a crew of three skippered by Rob Stanley. The *F/V Star Wars II* (CFV/VRN 20492) is an 80-foot, wood vessel, with a crew of three skippered by Rob Tournier.

2.2 SURVEY LOCATIONS

The Canadian portion of the IPHC survey consists of 170 fixed survey stations and is divided into four regions: Vancouver, Goose Islands, St. James, and Charlotte. Figure 1 shows the location of the IPHC fixed survey stations relative to the DFO management regions: North Coast (NC), Queen Charlotte Islands (QCI), Central Coast (CC) and West Coast Vancouver Island (WCVI). The *F/V Viking Joy* fished the southern regions, Vancouver and Goose Islands, and the *F/V Star Wars II* fished the northern regions, St.

James and Charlotte. Data within this report are summarized according to the four DFO management regions.

2.3 FISHING GEAR AND OPERATIONS

The chartered vessels use 'conventional' fishing gear and standardized fishing operations as required in the IPHC Charter Bid Specifications (www.iphc.washington.edu). Each set or 'string' of fishing gear consists of eight skates. A skate of gear measures 1,800 ft (549 m) and contains approximately 100, size 16/0 circle hooks spaced 18 ft (5.5 m) apart. In 2003, halibut from the first three skates were tagged with a passive integrated transponder (PIT) tag and released. The remaining five skates were used for the SSA survey.

At each survey station, the gear is set in either a north to south, or east to west direction regardless of the prevailing bathymetry. Minimum, maximum and average depths are recorded from the vessel's depth sounder. For analyses with depth considerations, only the sets with a depth range less than 50 fathoms (fa) are included.

The start and end positions of each set of fishing gear are recorded from the vessel's global positioning system when the first and last anchors are set over the stern. The duration of the fishing event, or 'soak time', of the set is calculated as the time elapsed between the last anchor set over the stern and the first anchor hauled aboard. Fishing events are a minimum of five hours, and are not permitted to exceed 24 hours.

2.4 CATCH DATA COLLECTIONS

2.4.1 Hook by Hook

The hooks are observed as the gear is hauled onboard at the end of the fishing event. The species caught, bait returned, or empty hook was recorded, on a hook by hook basis.

2.4.2 Biological sampling

Sampling of the rockfish catch occurs after the hook observations are completed for the set. Rockfish are gutted and gilled by the crew as they come aboard and set aside for biological sampling. A subsample of rockfish was measured for fork length prior to and after processing. To determine a conversion between dressed and round fork length, a linear regression was fit to the round and dressed fork length data.

Priority species for biological sampling are yelloweye rockfish (*Sebastes ruberrimus*) and sablefish (*Anoplopoma fimbria*), then other species such as redbanded (*S. babcocki*), quillback (*S. maliger*), copper (*S. caurinus*), china (*S. nebulosus*), tiger (*S. nigrocinctus*) and black (*S. melanops*) rockfishes. Biological sampling consists of measuring a dressed fork length (L) to the nearest millimetre (mm), visually examining the gonads to determine sex (S) and estimating the state of sexual maturity (M) (Appendix Table 1). Both sagittal otoliths (O) are excised for subsequent age determination. Otoliths are

removed from the ventral-side of the skull, posterior to the palate as the rockfish were dressed with the gills removed.

Onboard the *F/V Viking Joy* the first 50 sablefish from each set were sampled for LSMO and the rest were released. The *F/V Star Wars II* was permitted, with their K licence, to catch and retain sablefish during the SSA survey. All sablefish caught by the *F/V Star Wars II* were retained from each set and 50 sablefish were randomly sampled for LSMO. When the sampling time between sets was limited, only LSM samples were collected.

2.5 CATCH RATE

The catch rate (U) is defined as the total number of fish (N) divided by the number of intact skates returned (M) from the set. Lost or partial skates are not included in catch rate calculations (*F/V Viking Joy*, set 42, skates 1, 2, and 3). Mean catch rates ($\overline{U}$) are calculated as the sum of the catch rates by skate per set (U) divided by the number of sets (n).

$$U_{is} = \frac{N_{is}}{M_i} \qquad \overline{U} = \frac{1}{n}\sum_{i=1}^{n}\frac{N_{is}}{M_i}$$

where s denotes the species, and i denotes the set.

For rockfish by species, round weight (W) in grams is estimated from fork length (L) in millimetres using:

$$W = a\,L^{b}$$

Parameters a and b are determined using paired length and weight data from the DFO GFBio database. Values used for the following rockfish are:

quillback rockfish	$a=2.67(10)^{-7}$	b=3.34	(n=1380)
redbanded rockfish	$a=8.32(10)^{-7}$	b=3.12	(n=1091)
yelloweye rockfish	$a=2.83(10)^{-6}$	b=2.94	(n=2090)

Catch rate in kilograms per skate is used to calculate a relative catch rate in kilograms of rockfish per kilogram of halibut for each set.

Spatial distribution of catch rate is plotted, by set location, using ESRI ® ArcMap™ 8.3 software. Catch rates are illustrated using various graduated symbols to represent various quantities of catch.

2.6 SIMULATIONS

Catch rate data from fishing surveys are often used to calculate a biomass index. With data from a single year of the SSA, it is not possible to determine the utility of the SSA data as a biomass index. However, we use the catch rate data from the 2003 SSA and a simulation model (Schnute and Haigh 2003) to investigate whether the continued collection of rockfish catch data on the SSA would lead to a relative index that followed population trends.

The simulation model (Schnute and Haigh 2003) was initially used to plan and design trawl surveys. The model allows budgets (number of tows/sets) to be allocated among strata (habitat depth intervals) to minimize the coefficient of variation (CV) of the total biomass estimate. The model was simplified, similar to Sinclair et al. (2003), to assess the IPHC survey potential. The Area 2B of the SSA survey area from 20 to 248 fa depth was considered as one stratum and the budget was fixed at 170 sets, the number of IPHC survey stations within B.C.. Biomass density (catch per habitat area swept) is estimated from catch per effort data from the 2003 SSA. Each set i is a density measurement z_{is} of biomass per unit area for species s. Biomass (C_{is}) is converted from the number of fish caught (N), using the fish lengths (L) and the fork length to round weight conversion formula ($W=aL^b$). The area swept by a skate of longline gear is estimated by multiplying the skate length l by an assumed effective width w. Set length is 2743 m (9000 ft) and effective width is estimated as 9.144 m (30 ft) for this simulation model. The area swept by the longline gear (length by effective width) is used here to estimate a biomass in weight from catch rate data in weight per skate. This biomass estimate is not intended as an absolute biomass but rather a relative biomass index.

$$z_{is} = \frac{C_{is}}{l_i w_i}$$

The n sets in the survey give the mean density estimate

$$\bar{z}_s = \frac{1}{n}\sum_{i=1}^{n} z_{is}$$

The relative stock biomass is estimated by applying the biomass density to the available habitat area. ArcMap™ 8.3 Spatial Analyst is used to calculate the ocean surface area of the SSA survey in Area 2B within the 20-248 fa depth stratum. One simulation generates a data set of density measurements that give the biomass estimate ($\hat{B}_s$).

$$\hat{B}_s = A\bar{z}_s$$

The simulation model treats each biomass density estimate (z_{is}) as a random variable drawn from a compound binomial-gamma distribution with three parameters:

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1) P proportion of sets with zero catch
2) μ mean density of non-zero sets
3) ρ coefficient of variation of non-zero sets.

P, μ and ρ are estimated from the 2004 SSA rockfish catch data, by species, for all 170 sets of the survey. The model assumes that set i fails to capture species s ($z_{is} = 0$) with probability P or is successful at catching species s ($z_{is} > 0$), which follows a gamma distribution with mean μ and coefficient of variation determined by the parameter ρ.

Density is determined from the properties of the binomial-gamma distribution (Schnute and Haigh 2003) as

$$\delta_s = (1 - P_s)\mu_s$$

The true biomass B_s is known and given by

$$B_s = \sum A\delta_s$$

and can be compared with the estimate $\hat{B}_s$

For the simulations we assume two scenarios, 'pessimistic' and 'optimistic' where the true biomass is fixed to grow at 2% and 5% compounded annually and process error is fixed at 0.2 and 0.15, respectively. The pessimistic and optimistic scenarios are reviewed and the utility of the IPHC survey catch rates as a rockfish biomass index is considered.

3.0 RESULTS AND DISCUSSION

3.1 SURVEY LOCATIONS

The *F/V Viking Joy* conducted a single set at all 84 stations in the Vancouver and Goose Islands regions from May 27 through July 11, 2003 and the *F/V Star Wars II* conducted a single set at all 86 stations in the St. James and Charlotte regions from July 5 through August 11, 2003 (Figure 1 and Appendix Table 2). Set depths ranged from 16 to 278 fa, with the average set depth ranging from 20 to 248 fa. Twelve of the 170 sets had depth ranges that exceeded 50 fathoms. All stations were fished during daylight hours with gear deployment between 0500h and 0854h (Appendix Table 3). Soak times varied from 5.00 hours to 11.95 hours, and all gear was retrieved by 2230h.

The number of survey locations is distributed evenly among the IPHC survey regions but not among the DFO management regions. DFO management regions vary greatly in size with the NC containing the least number of survey locations and the CC the most (Table 1).

3.2 CATCH SUMMARY

Data from the 2003 IPHC SSA survey are archived in the DFO GFBio database and can be retrieved by using TRIP_IDs 52040 and 52041.

3.2.1 Hook by Hook

Fifty two percent of the retrieved hooks were empty, 23% yielded a fish or invertebrate, and 24% had bait or bait skin returned (Table 2). Drop-offs, heads, and unobserved hooks were uncommon making up the remaining 1% of the hooks retrieved.

A total of 54 species were encountered on the survey, 38 of which were marine fish (Table 3). Spiny dogfish (*Squalus acanthias*) were the most common species encountered at 14,166 fish and together with Pacific halibut and sablefish at 7,197 and 4,168 fish, respectively, comprised 80% of the total number of fish caught. Arrowtooth flounder (*Atheresthes stomias*) and longnose skate (*Raja rhina*) made up 4% and 3% of the overall number of marine fish caught, respectively. Redbanded and yelloweye rockfishes were the most common rockfish encountered at 1,309 and 1,225 fish, respectively, together comprising 8 % of the total number of fish caught. Other rockfish encountered in the survey were rougheye (*Sebastes aleutianus*), quillback, silvergray (*S. brevispinis*), shortraker (*S. borealus*), bocaccio (*S. paucispinus*), canary (*S. pinniger*), yellowmouth (*S. reedi*), yellowtail (*S. flavidus*), and china rockfish. These other rockfishes, in total, comprised 3% of the total number of fish caught.

The greatest numbers of dogfish were caught off the WCVI. Sablefish were common in all areas except the NC and the majority of rockfish were caught in the CC and QCI. The species catch does not simply reflect the number of survey locations within the management area and likely varies in relation to the habitat type and the depth fished.

Yelloweye rockfish was the most common rockfish caught in the CC, QCI, WCVI, and 51% of all yelloweye rockfish (in numbers) were caught in the QCI. Redbanded rockfish was the most commonly caught rockfish in the CC. Seventy percent (in numbers) of all redbanded rockfish were caught in the CC. Quillback rockfish was the most common rockfish caught in the NC. The average depths fished in the NC area were shallow ranging from 20 – 76 m, and may account for the quillback rockfish catch exceeding that of all other rockfish species in this area.

3.2.2 Biological sampling

A total of 1,967 rockfish and 1,730 sablefish were sampled for LSMO, and 486 sablefish were sampled for LSM, and 25 sablefish were sampled for LS during the survey (Table 4.). A list of all biological samples collected by set onboard each charter vessel is presented in Appendix Table 4 for the *F/V Viking Joy* and Appendix Table 5 for the *F/V Star Wars II.*

More than 50% of the redbanded, rougheye and quillback rockfishes caught during the survey were female and more than 50% of the yelloweye rockfish were male (Figure 2).

For rockfishes, dressed fork lengths below about 450 mm are shorter than round fork lengths and above 450 mm are longer. Dressed fork lengths are used in the analyses. The linear relationship between dressed (DFL) and round (RFL) fork length in millimetres is shown in Figure 3 and expressed as

$$RFL = 1.0209\ (DFL) - 9.6375 \qquad (r^2=0.994)$$

Length frequency statistics for rockfish by species and sablefish are summarized for all regions surveyed in Table 5 and by management region in Table 6. Stratifying the length data by IPHC survey region (by latitude), significant differences in mean length were found for quillback and yelloweye rockfishes (one-way Anova, $p<0.01$, Table 7). Quillback rockfish mean length generally decreased with latitude with the largest fish caught in the Vancouver region. Vancouver region quillback rockfish were significantly larger than those from the Charlotte and St. James regions. The opposite was generally true for yelloweye rockfish mean length. Size increased with latitude with the exception of the most northerly region, Charlotte. The St. James yelloweye rockfish were significantly larger than those from the other regions. Similar increases in mean size were noted from yelloweye rockfish study sites in the St. James to Vancouver regions (Kronlund and Yamanaka 2001). A number of nearshore rockfish move into deeper water with ontogeny and length will increase with depth (Lea et al. 1999). This has been shown for quillback rockfish taken in B.C. research surveys (Yamanaka and Richards 1993). Set depth is not stratified in the survey and is not considered in this IPHC analysis.

Length frequencies by sex for quillback, redbanded, rougheye and yelloweye rockfishes over all regions surveyed are shown in Figure 4. Females were generally larger than males for the rockfishes examined. This may have been an artefact of the sampling as more females were sampled for these species with the exception of yelloweye rockfish. Male yelloweye rockfish had a broader size range than females and had the largest individual fish.

Sexual maturity data are summarized by sex and maturity stage for rockfish by species in Table 8. The majority of rockfish are mature with males either in the 'developing' or 'spent' stage and females in the 'spent' or 'resting' stage. For redbanded and yelloweye rockfishes, parturition takes place in the spring and the majority of the females are 'spent' by June (Figure 5 and 6).

Due to the time required for age determination, these data are not presented.

3.3 CATCH RATE

Overall mean rockfish catch rates ranged from 0.00074 fish per skate for china rockfish up to 0.96 fish/skate for redbanded rockfish (Table 9). Overall median rockfish catch

rates were 0, indicating that over half of the skates did not catch a rockfish. The mean number of quillback rockfish/skate ranged from 0.058 in the CC to 0.26 in the NC, redbanded rockfish/skate ranged from 0.104 in the NC to 1.87 in the CC and yelloweye rockfish/skate ranged from 0.208 in the NC to 1.76 in the QCI (Table 10).

The spatial distribution of catch rates in numbers of fish/skate by species for rockfishes and sablefish are shown in Figure 7. Sablefish and quillback, redbanded and yelloweye rockfishes were caught throughout all areas. Canary, rougheye and shortraker rockfishes were caught in all areas except the NC. Bocaccio and silvergray rockfishes were caught only in the northern portion of B.C. and china, yellowmouth and yellowtail rockfishes were caught infrequently.

Catch rates by species for sets where the range in depth was less than 50 fathoms were plotted against average set depths (Figure. 8.). Sablefish catch rates increase with depth and rockfish catch rates suggest depth preferences with peaks in abundance within specific depth ranges. The average set depths at peak catch rates for quillback, silvergray, yelloweye, redbanded, and rougheye rockfish are 42, 78, 102, 114, and 212 fathoms, respectively.

3.3.1 Relative Catch

Overall mean relative rockfish to halibut catches were 0.0023, 0.031 and 0.048 kilograms for quillback, yelloweye and redbanded rockfishes, respectively (Table 11.). For these rockfish combined, the median catch rate overall for the survey was low at 0.02 kg rockfish/kg halibut per set. Highest mean relative catch rates by species for rockfish to halibut were 0.005 kg for quillback and 0.045 kg for yelloweye on the WCVI and 0.097 for redbanded in the CC. The highest relative quillback, redbanded and yelloweye rockfish combined catch to halibut catch was 0.13 kg in the CC.

The spatial distribution of the relative quillback rockfish catch to halibut catch, in kilograms, was low in all areas (Figure 9). Relative yelloweye rockfish catch to halibut catch was highest at 0.74 kg, off the lower portion of the WCVI. Redbanded rockfish catch to halibut catch was highest in the CC. The combined rockfish catch to halibut catch was highest in the CC, lower portion of the QCI and upper portion of the WCVI.

3.4 SIMULATIONS

The input data for the model's fixed parameters P, μ and ρ were derived from quillback, redbanded, and yelloweye rockfish catch data, by species, from all 170 sets of the SSA survey within Area 2B (Table 12). Figures 10 and 11 show three simulations, for each rockfish species, projecting the known biomass (B_s) and the annual biomass estimates ($\hat{B}_s$) 20 years into the future. Figure 10 shows the 'pessimistic' scenario with a population biomass growth rate of 2% compounded annually and 20% process error. Figure 11 shows the 'optimistic' scenario with a known biomass growth rate of 5% compounded annually and 15% process error. Trends in the estimated biomass (loess line) appear to track increases in abundance of the known population for these rockfishes

over the 20 years. The total coefficients of variation, CV_t, are low for all three species, and the 'best' index (lowest CV_t) is for yelloweye rockfish. Yelloweye rockfish catch rates are less variable than those for redbanded and quillback rockfishes and are therefore more likely to yield an abundance index.

Covering up the future annual estimates and revealing each survey data point one year at a time, the trend in biomass estimates is reliably detected earlier in the 'optimistic' series than the 'pessimistic' series. Trends from the 'pessimistic' simulations appear to track abundance two times out of three over a 10 to15 year time frame. Trends from the 'optimistic' simulations are detected, two out of three times in 5 to 7 years. Departures of the loess line fit from the biomass estimates show that both under and over estimates of the biomass are likely. A trend line, over the short term of 2 to 4 years of biomass estimates does not consistently track the known population. For example, redbanded rockfish 'Sim 1', the initial data points indicate that the population is declining. Yelloweye rockfish biomass in 'Sim 1', appears to be stable in the early years and under estimated in magnitude.

Results from the simulation model indicate that, over the long term, the catch rate index from the SSA survey will be useful to track abundance trends for quillback, yelloweye and redbanded rockfishes. Refinements to this analysis, using a depth stratified approach did not improve the index (lower the CVs) most likely due to the lower sample size within each stratum. A feature to enhance the simulation model would be to allow the initial input variables to vary with the known population biomass. As the population density increases, P and ρ would expect to decrease rather than remain the same as it does in the current simulation model.

To compare fish densities between IPHC SSA surveys, an assumption of the fixed station design is that fish distribution remains static with respect to the survey station allocation scheme (Sinclair etal 2003). This assumption is probably not violated for yelloweye and quillback rockfishes that tend to be habitat and reef specific. With additional data from future surveys, it may be possible to improve the analyses by better estimating process error.

4.0 SUMMARY

The IPHC has conducted a fixed station stock assessment survey in B.C. since 1963 and is the only coastwide longline survey conducted in B.C. In 2003, an additional technician was deployed on the survey to identify and record the catch to species and sample sablefish and rockfishes for biological data. In addition to halibut, dogfish and sablefish were commonly caught on the survey, as were rockfishes. Redbanded and yelloweye rockfishes were the most commonly caught rockfishes.

In general, quillback rockfish increased in size from north to south. The trend was reversed for yelloweye rockfish. Female rockfishes tended to be larger than the males. Most female redbanded and yelloweye rockfishes were sexually mature and were in the spent or resting stages by June.

Rockfish to halibut catch rates were highest in the Central Coast, the southern end of the Queen Charlotte Islands and the northern end of Vancouver Island but in general were low at 0.02 kg rockfish/kg halibut per skate (overall median). Quillback, redbanded and yelloweye rockfish catch rates from the survey were used to estimate the initial inputs for a simulation model (Schnute and Haigh 2003). From a 'pessimistic' simulation scenario, reliable trends in population biomass, at worst, will not be detected through the SSA and at best, will be detected over a 10 to 15 year time horizon. Under a more 'optimistic' simulation scenario, annual data collections on the IPHC survey may provide a reliable trend in abundance for quillback, redbanded and yelloweye rockfishes as early as 2009. Improvements to the estimation of process error and simulation may improve these initial outcomes.

In addition to the catch composition data collected onboard the IPHC SSA charter vessels, the third technician collected biological sample data. This rockfish age composition, sex and maturity data will be useful for stock assessments as samples are obtained annually throughout the entire B.C. coast. The age data is not yet available for analysis and has not been discussed in this document.

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Table 1. Numbers of IPHC survey stations within IPHC survey regions and DFO management regions.

IPHC Survey Region	# of sites
Charlotte	44
St. James	42
Goose Island	43
Vancouver	41
DFO Management Region	**# of sites**
QCI	44
NC	12
CC	60
WCVI	54

Table 2. Summary of hook observations by description, DFO GFBio database code, number of hooks retrieved and percent of total hooks.

Description	GFBio Code	# hooks	% of total
Empty hook	1	70315	52.10
Bait on hook	2	19755	14.64
Animal on hook (fish or invertebrate)	3	31483	23.33
Species head on hook	4	440	0.33
Species dropped off hook	5	317	0.23
Bait skin on hook	6	12629	9.36
Hook not observed	7	18	0.01
Total		**134957**	**100.00**

Table 3. Summary of catch, in numbers by common name, taxonomic name, DFO management region of capture and total overall regions in numbers and percent of marine fish species.

Common Name	Scientific Name	WCVI	QCI	NC	CC	Total	% Total
SPINY DOGFISH	*SQUALUS ACANTHIAS*	9778	1028	556	2804	14166	44.48
PACIFIC HALIBUT	*HIPPOGLOSSUS STENOLEPIS*	1435	2795	693	2274	7197	22.60
SABLEFISH	*ANOPLOPOMA FIMBRIA*	1252	1495	193	1228	4168	13.09
ARROWTOOTH FLOUNDR	*ATHERESTHES STOMIAS*	339	390	301	351	1381	4.34
REDBANDED ROCKFISH	*SEBASTES BABCOCKI*	98	306	10	895	1309	4.11
YELLOWEYE ROCKFISH	*SEBASTES RUBERRIMUS*	180	621	20	404	1225	3.85
LONGNOSE SKATE	*RAJA RHINA*	210	232	83	401	926	2.91
ROUGHEYE ROCKFISH	*SEBASTES ALEUTIANUS*	16	230	0	41	287	0.90
STARFISH	*ASTERIODEA*	95	38	113	40	286	-
LINGCOD	*OPHIODON ELONGATUS*	72	126	12	52	262	0.82
BIG SKATE	*RAJA BINOCULATA*	97	53	39	34	223	0.70
SHORTSPINE THORNYHD	*SEBASTOLOBUS ALASCANUS*	8	155	0	39	202	0.63
QUILLBACK ROCKFISH	*SEBASTES MALIGER*	57	45	25	28	155	0.49
PACIFIC COD	*GADUS MACROCEPHALUS*	8	37	13	21	79	0.25
SILVERGRAY ROCKFISH	*SEBASTES BREVISPINIS*	0	54	0	8	62	0.19
SPOTTED RATFISH	*HYDROLAGUS COLLIEI*	6	25	12	15	58	0.18
SHORTRAKER ROCKFISH	*SEBASTES BOREALIS*	6	16	0	11	33	0.10
BLUE SHARK	*PRIONACE GLAUCA*	0	9	0	10	19	0.06
BOCACCIO	*SEBASTES PAUCISPINIS*	0	17	0	2	19	0.06
CANARY ROCKFISH	*SEBASTES PINNIGER*	4	12	0	3	19	0.06
FISH-EATING STAR	*STYLASTERIAS FORRERI*	14	4	0	0	18	-
SPONGES	*PORIFERA*	2	4	2	8	16	-
ANEMONE	*ACTINIARIA*	6	0	3	3	12	-
PETRALE SOLE	*EOPSETTA JORDANI*	0	10	0	0	10	0.03
SEA CUCUMBER	*HOLOTHUROIDEA*	9	0	0	0	9	-
PACIFIC SLEEPER SHARK	*SOMNIOSUS PACIFICUS*	0	5	0	3	8	0.03
SANDPAPER SKATE	*BATHYRAJA INTERRUPTA*	0	4	0	3	7	0.02
PARAGORGIA PACIFICA C	*PARAGORGIA PACIFICA*	0	6	0	0	6	-
SOUPFIN SHARK	*GALEORHINUS ZYOPTERUS*	0	0	0	5	5	0.02
SCALLOP	*PECTINIDAE*	5	0	0	0	5	-
OCTOPUS	*OCTOPODA*	2	1	2	0	5	-
UNIDENTIFIED SHARK		0	4	0	0	4	0.01
SOFT CORALS	*ALCYONACEA*	0	3	1	0	4	-
BIVALVE MOLLUSCS	*BIVALVIA*	0	0	4	0	4	-
SOUTHERN ROCK SOLE	*LEPIDOPSETTA BILINEATA*	0	0	2	2	4	0.01
WOLF EEL	*ANARRHICHTHYS OCELLATUS*	1	1	0	1	3	0.01
YELLOWMOUTH ROCKF.	*SEBASTES REEDI*	1	0	0	2	3	0.01
UNKNOWN FISH		0	1	1	0	2	0.01
SIXGILL SHARK	*HEXANCHUS GRISEUS*	1	1	0	0	2	0.01
WALLEYE POLLOCK	*THERAGRA CHALCOGRAMMA*	0	0	0	2	2	0.01
PACIFIC SANDDAB	*CITHARICHTHYS SORDIDUS*	2	0	0	0	2	0.01
DOVER SOLE	*MICROSTOMUS PACIFICUS*	1	0	0	1	2	0.01
SKATES	*RAJIDAE*	0	1	0	0	1	0.00
COHO SALMON	*ONCORHYNCHUS KISUTCH*	1	0	0	0	1	0.00
HYDROID	*HYDROZOA*	1	0	0	0	1	-
SEA PENS	*PENNATULACEA*	0	0	1	0	1	-
SEA WHIP	*OSTEOCELLA SEPTENTRIONALIS*	0	1	0	0	1	-
YELLOWTAIL ROCKFISH	*SEBASTES FLAVIDUS*	1	0	0	0	1	0.00
CHINA ROCKFISH	*SEBASTES NEBULOSUS*	1	0	0	0	1	0.00
BASKET STARS	*EURYALAE*	1	0	0	0	1	-
FLATHEAD SOLE	*HIPPOGLOSSOIDES ELASSODON*	0	0	1	0	1	0.00
BUTTER SOLE	*ISOPSETTA ISOLEPIS*	0	1	0	0	1	0.00
STELLER SEA LION	*EUMETOPIAS JUBATUS*	1	0	0	0	1	-
LITHODES CRAB	*LITHODES*	0	0	0	1	1	-
					Marine Fish Total	**31850**	

Table 3. Summary of catch, in numbers by common name, taxonomic name, DFO management region of capture and total overall regions in numbers and percent of marine fish species.

Common Name	Scientific Name	WCVI	QCI	NC	CC	Total	% Total
SPINY DOGFISH	*SQUALUS ACANTHIAS*	9778	1028	556	2804	14166	44.48
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YELLOWEYE ROCKFISH	*SEBASTES RUBERRIMUS*	180	621	20	404	1225	3.85
LONGNOSE SKATE	*RAJA RHINA*	210	232	83	401	926	2.91
ROUGHEYE ROCKFISH	*SEBASTES ALEUTIANUS*	16	230	0	41	287	0.90
STARFISH	*ASTERIOIDEA*	95	38	113	40	286	-
LINGCOD	*OPHIODON ELONGATUS*	72	126	12	52	262	0.82
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SHORTSPINE THORNYHD	*SEBASTOLOBUS ALASCANUS*	8	155	0	39	202	0.63
QUILLBACK ROCKFISH	*SEBASTES MALIGER*	57	45	25	28	155	0.49
PACIFIC COD	*GADUS MACROCEPHALUS*	8	37	13	21	79	0.25
SILVERGRAY ROCKFISH	*SEBASTES BREVISPINIS*	0	54	0	8	62	0.19
SPOTTED RATFISH	*HYDROLAGUS COLLIEI*	6	25	12	15	58	0.18
SHORTRAKER ROCKFISH	*SEBASTES BOREALIS*	6	16	0	11	33	0.10
BLUE SHARK	*PRIONACE GLAUCA*	0	9	0	10	19	0.06
BOCACCIO	*SEBASTES PAUCISPINIS*	0	17	0	2	19	0.06
CANARY ROCKFISH	*SEBASTES PINNIGER*	4	12	0	3	19	0.06
FISH-EATING STAR	*STYLASTERIAS FORRERI*	14	4	0	0	18	-
SPONGES	*PORIFERA*	2	4	2	8	16	-
ANEMONE	*ACTINIARIA*	6	0	3	3	12	-
PETRALE SOLE	*EOPSETTA JORDANI*	0	10	0	0	10	0.03
SEA CUCUMBER	*HOLOTHUROIDEA*	9	0	0	0	9	-
PACIFIC SLEEPER SHARK	*SOMNIOSUS PACIFICUS*	0	6	0	3	9	0.03
SANDPAPER SKATE	*BATHYRAJA INTERRUPTA*	0	4	0	3	7	0.02
PARAGORGIA PACIFICA C	*PARAGORGIA PACIFICA*	0	6	0	0	6	-
SOUPFIN SHARK	*GALEORHINUS ZYOPTERUS*	0	0	0	6	6	0.02
SCALLOP	*PECTINIDAE*	5	0	0	0	5	-
OCTOPUS	*OCTOPODA*	2	1	2	0	5	-
UNIDENTIFIED SHARK		0	4	0	0	4	0.01
SOFT CORALS	*ALCYONACEA*	0	3	1	0	4	-
BIVALVE MOLLUSCS	*BIVALVIA*	0	0	4	0	4	-
SOUTHERN ROCK SOLE	*LEPIDOPSETTA BILINEATA*	0	0	2	2	4	0.01
WOLF EEL	*ANARRHICHTHYS OCELLATUS*	1	1	0	1	3	0.01
YELLOWMOUTH ROCKF.	*SEBASTES REEDI*	1	0	0	2	3	0.01
UNKNOWN FISH		0	1	1	0	2	0.01
SIXGILL SHARK	*HEXANCHUS GRISEUS*	1	1	0	0	2	0.01
WALLEYE POLLOCK	*THERAGRA CHALCOGRAMMA*	0	0	0	2	2	0.01
PACIFIC SANDDAB	*CITHARICHTHYS SORDIDUS*	2	0	0	0	2	0.01
DOVER SOLE	*MICROSTOMUS PACIFICUS*	1	0	0	1	2	0.01
SKATES	*RAJIDAE*	0	1	0	0	1	0.00
COHO SALMON	*ONCORHYNCHUS KISUTCH*	1	0	0	0	1	0.00
HYDROID	*HYDROZOA*	1	0	0	0	1	-
SEA PENS	*PENNATULACEA*	0	0	1	0	1	-
SEA WHIP	*OSTEOCELLA SEPTENTRIONALIS*	0	1	0	0	1	-
YELLOWTAIL ROCKFISH	*SEBASTES FLAVIDUS*	1	0	0	0	1	0.00
CHINA ROCKFISH	*SEBASTES NEBULOSUS*	1	0	0	0	1	0.00
BASKET STARS	*EURYALAE*	1	0	0	0	1	-
FLATHEAD SOLE	*HIPPOGLOSSOIDES ELASSODON*	0	0	1	0	1	0.00
BUTTER SOLE	*ISOPSETTA ISOLEPIS*	0	1	0	0	1	0.00
STELLER SEA LION	*EUMETOPIAS JUBATUS*	1	0	0	0	1	-
LITHODES CRAB	*LITHODES*	0	0	0	1	1	-
					Marine Fish Total	31850	

Table 4. Summary of the number (N) of fish, by species, sampled from the survey. Biological samples of length, sex, maturity and otoliths (LSMO) and length, sex and maturity (LSM), and length and sex (LS) are summarized by species.

LSMO samples	N
redbanded	866
yelloweye	838
quillback	115
rougheye	102
silvergray	21
shortraker	15
canary	5
bocaccio	4
china	1
all rockfish	1967
all sablefish	1730

LSM samples	N
sablefish	486

LS samples	N
sablefish	25

Table 5. Summary statistics for rockfish and sablefish fork length (mm) over all survey regions.

All Regions	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	762	455	355	406	514	499	616	730	541	568
Standard Error	36.97	33.75	0.00	3.05	1.83	4.31	2.20	28.89	18.14	2.38
Median	743	420	355	410	516	496	606	708	522	569.5
Mode	N/A	N/A	N/A	418	551	481	496	N/A	N/A	526
Standard Deviation	73.93	75.46	N/A	32.74	53.75	43.57	103.34	111.91	83.14	68.96
Sample Variance	5465.67	5694.20	N/A	1071.58	2889.44	1897.98	10678.38	12522.92	6911.59	4755.93
Range	166	180	0	151	285	209	651	426	275	380
Minimum	697	391	355	321	365	410	408	572	411	382
Maximum	863	571	355	472	650	619	1059	998	686	762
Count	4	5	1	115	866	102	2216	15	21	838
Confidence Level (95.0%)	117.64	93.70	N/A	6.05	3.59	8.56	4.30	61.97	37.84	4.68

Table 6. Summary statistics for rockfish and sablefish fork length (mm) by DFO management region.

Queen Charlotte Islands	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	762	531	–	386	500	500	630	730	541	552
Standard Error	36.97	40.00	–	7.26	4.61	4.61	3.75	28.89	18.14	4.06
Median	743	531	–	375	499	499	612	708	522	556
Mode	N/A	N/A	–	375	529	529	551	N/A	N/A	474
Standard Deviation	73.93	56.57	–	33.26	54.96	54.96	98.74	111.91	83.14	69.93
Sample Variance	5465.67	3200.00	–	1106.15	3020.43	3020.43	9749.85	12522.92	6911.59	4890.54
Range	166	80	–	116	271	271	602	426	275	315
Minimum	697	491	–	321	365	365	457	572	411	411
Maximum	863	571	–	437	636	636	1059	998	686	726
Count	4	2	–	21	142	142	693	15	21	296
Confidence Level(95.0%)	117.64	508.25	–	15.14	9.12	9.12	7.36	61.97	37.84	8.00

North Coast	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	–	–	–	405	546	–	525	–	–	595
Standard Error	–	–	–	6.54	19.62	–	2.78	–	–	16.18
Median	–	–	–	413	544.5	–	522.5	–	–	582
Mode	–	–	–	426	604	–	505	–	–	N/A
Standard Deviation	–	–	–	31.34	55.50	–	32.45	–	–	72.35
Sample Variance	–	–	–	982.39	3080.41	–	1053.06	–	–	5234.69
Range	–	–	–	115	149	–	225	–	–	251
Minimum	–	–	–	343	455	–	427	–	–	511
Maximum	–	–	–	458	604	–	652	–	–	762
Count	–	–	–	23	8	–	136	–	–	20
Confidence Level(95.0%)	–	–	–	13.55	46.40	–	5.50	–	–	33.86

Table 6 continued.

Central Coast	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	–	–	–	400	519	515	604	–	–	587
Standard Error	–	–	–	4.94	2.07	27.69	3.68	–	–	3.50
Median	–	–	–	397.5	523	500	594	–	–	596
Mode	–	–	–	419	551	N/A	496	–	–	604
Standard Deviation	–	–	–	26.15	51.94	55.37	106.50	–	–	66.05
Sample Variance	–	–	–	683.72	2697.32	3066.25	11341.44	–	–	4362.49
Range	–	–	–	103	284	129	558	–	–	332
Minimum	–	–	–	347	366	465	408	–	–	401
Maximum	–	–	–	450	650	594	966	–	–	733
Count	–	–	–	28	629	4	838	–	–	356
Confidence Level(95.0%)	–	–	–	10.14	4.07	88.11	7.22	–	–	6.88

West Coast Vancouver I	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	–	405	355	419	498	–	640	–	–	551
Standard Error	–	8.41	0.00	4.93	6.19	–	4.30	–	–	4.79
Median	–	403	355	418	496	–	642	–	–	548.5
Mode	–	N/A	N/A	418	528	–	646	–	–	548
Standard Deviation	–	14.57	N/A	32.30	57.75	–	100.83	–	–	61.67
Sample Variance	–	212.33	N/A	1043.32	3334.94	–	10166.11	–	–	3802.81
Range	–	29	0	133	269	–	632	–	–	326
Minimum	–	391	355	339	368	–	413	–	–	382
Maximum	–	420	355	472	637	–	1045	–	–	708
Count	–	3	1	43	87	–	549	–	–	166
Confidence Level(95.0%)	–	36.20	N/A	9.94	12.31	–	8.45	–	–	9.45

Table 7. Summary of one-way analysis of variance tests for differences in fork length (mm) by IPHC survey region

QUILLBACK	Mean	N	F	df	p
Charlotte	398.02	41	4.24	3,110	0.0070*
St. James	395.25	20			
Goose Island	409.91	33			
Vancouver	424.90	20			

Pairwise Comparisons: Vancouver significantly larger ($p<0.05$) than Charlotte and St. James ($t>2.687$)

REDBANDED	Mean	N	F	df	p
Charlotte	516.73	180	1.88	3,862	0.1314
St. James	516.09	482			
Goose Island	505.58	149			
Vancouver	507.51	55			

YELLOWEYE	Mean	N	F	df	p
Charlotte	558.88	171	5.76	3, 834	0.0007*
St. James	579.98	326			
Goose Island	562.66	235			
Vancouver	556.76	106			

Pairwise Comparisons: St. James significantly larger ($p<0.05$) than Charlotte, Goose Island, and Vancouver ($t>2.645$)

Table 8. Sexual maturity assessments are presented by sex for rockfish by species, showing the number of fish (proportion) in each maturity stage and the total number of fish sampled.

ROCKFISH	Number (Proportion) of Individuals in Each Maturity Stage							Total
MALE	Immature	Maturing	Developing	Developed	Running	Spent	Resting	N
Bocaccio	0	0	0	2 (1.00)	0	0	0	2
Canary	0	0	0	1 (1.00)	0	0	0	1
China	0	0	0	0	0	0	0	0
Quillback	0	1 (0.02)	19 (0.37)	12 (0.24)	0	17 (0.33)	2 (0.04)	51
Redbanded	0	5 (0.02)	23 (0.07)	145 (0.44)	1 (0.003)	133 (0.40)	20 (0.06)	333
Rougheye	2 (0.04)	4 (0.08)	3 (0.06)	20 (0.41)	1 (0.02)	17 (0.35)	2 (0.04)	49
Shortraker	0	0	0	2 (0.22)	0	7 (0.78)	0	9
Silvergray	6 (0.46)	0	0	0	0	7 (0.54)	0	13
Yelloweye	12 (0.03)	50 (0.11)	95 (0.21)	72 (0.16)	1 (0.002)	217 (0.47)	15 (0.03)	462
ROCKFISH	**Number (Proportion) of Individuals in Each Maturity Stage**							**Total**
FEMALE	Immature	Maturing	Mature	Fertilized	Larvae	Spent	Resting	**N**
Bocaccio	0	0	0	0	0	0	2 (1.00)	2
Canary	0	1 (0.25)	2 (0.50)	1 (0.25)	0	0	0	4
China	0	0	0	0	0	1 (1.00)	0	1
Quillback	0	2 (0.03)	4 (0.06)	6 (0.10)	1 (0.02)	41 (0.65)	9 (0.14)	63
Redbanded	0	19 (0.04)	21 (0.04)	19 (0.04)	7 (0.01)	325 (0.63)	128 (0.25)	519
Rougheye	0	1 (0.02)	13 (0.25)	1 (0.02)	1 (0.02)	15 (0.28)	22 (0.42)	53
Shortraker	0	0	2 (0.33)	0	0	2 (0.33)	2 (0.33)	6
Silvergray	1 (0.13)	0	1 (0.13)	0	0	0	6 (0.75)	8
Yelloweye	1 (0.003)	13 (0.04)	40 (0.11)	32 (0.09)	12 (0.03)	201 (0.54)	71 (0.19)	370

Table 9. Summary statistics for rockfish and sablefish catch rates in number of fish per skate over all survey regions.

All Areas	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	0.014	0.014	0.00074	0.11	0.96	0.21	3.06	0.024	0.046	0.90
Standard Error	0.00494	0.00603	0.000735	0.0264	0.209	0.0851	0.387	0.0109	0.0147	0.190
Median	0	0	0	0	0	0	0.375	0	0	0
Standard Deviation	0.0644	0.0786	0.00959	0.344	2.730	1.110	5.039	0.142	0.192	2.480
Sample Variance	0.00415	0.00618	0.0000919	0.118	7.454	1.232	25.396	0.0200	0.0369	6.149
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	0.375	0.875	0.125	2.000	28.500	11.125	27.375	1.375	1.500	22.875
Total Number of Skates	1357	1357	1357	1357	1357	1357	1357	1357	1357	1357
Confidence Level (95%)	0.00975	0.0119	0.00145	0.0521	0.413	0.168	0.763	0.0214	0.0291	0.375
Coefficient of Variation	4.61	5.63	13.04	3.02	2.84	5.28	1.64	5.83	4.22	2.75

Table 10. Summary statistics for rockfish and sablefish catch rates in numbers of fish per skate by DFO management region.

Queen Charlotte Is.	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	0.048	0.034	0	0.13	0.87	0.65	4.25	0.045	0.15	1.76
Standard Error	0.0173	0.0209	0	0.0565	0.337	0.314	0.908	0.0318	0.0520	0.616
Median	0	0	0	0	0	0	1.25	0	0	0
Standard Deviation	0.115	0.138	0	0.375	2.236	2.083	6.024	0.211	0.345	4.083
Sample Variance	0.0132	0.0192	0	0.141	4.999	4.341	36.285	0.0444	0.119	16.672
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	0.375	0.875	0	1.625	12.875	11.125	22.000	1.375	1.500	22.875
Total Number of Skates	352	352	352	352	352	352	352	352	352	352
Confidence Level (95%)	0.0350	0.0421	0	0.114	0.680	0.633	1.831	0.0641	0.105	1.241

North Coast	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	0	0	0	0.26	0.10	0	2.01	0	0	0.21
Standard Error	0	0	0	0.137	0.0840	0	0.938	0	0	0.119
Median	0	0	0	0	0	0	0.188	0	0	0
Standard Deviation	0	0	0	0.475	0.291	0	3.248	0	0	0.411
Sample Variance	0	0	0	0.226	0.0848	0	10.552	0	0	0.169
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	0	0	0	1.500	1.000	0	11.000	0	0	1.250
Total Number of Skates	96	96	96	96	96	96	96	96	96	96
Confidence Level (95%)	0	0	0	0.302	0.185	0	2.064	0	0	0.261

Table 10 continued.

Central Coast	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	0.0042	0.0063	0	0.058	1.86	0.083	2.56	0.023	0.017	0.84
Standard Error	0.00417	0.003547	0	0.0347	0.514	0.0493	0.460	0.0172	0.0109	0.248
Median	0	0	0	0	0.625	0	0.6875	0	0	0
Standard Deviation	0.0323	0.0275	0	0.269	3.984	0.382	3.566	0.133	0.0845	1.919
Sample Variance	0.00104	0.000755	0	0.0723	15.874	0.146	12.719	0.0177	0.00713	3.683
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	0.250	0.125	0	2.000	28.500	2.375	13.125	1.000	0.625	8.875
Total Number of Skates	480	480	480	480	480	480	480	480	480	480
Confidence Level (95%)	0.00834	0.00710	0	0.0695	1.029	0.0987	0.921	0.0344	0.0218	0.496

W.Coast Vancouver Is.	Bocaccio	Canary	China	Quillback	Redbanded	Rougheye	Sablefish	Shortraker	Silvergray	Yelloweye
Mean	0	0.0093	0.0023	0.13	0.23	0.037	2.90	0.014	0	0.42
Standard Error	0	0.007279	0.0023148	0.0485	0.0836	0.0197	0.787	0.0118	0	0.135
Median	0	0	0	0	0	0	0	0	0	0
Standard Deviation	0	0.0535	0.0170	0.356	0.614	0.145	5.785	0.0864	0	0.989
Sample Variance	0	0.002861	0.000289	0.127	0.377	0.0210	33.461	0.00747	0	0.978
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	0	0.375	0.125	1.750	3.125	0.875	27.375	0.625	0	5.750
Total Number of Skates	429	429	429	429	429	429	429	429	429	429
Confidence Level (95%)	0	0.014599	0.0046429	0.0973	0.168	0.0396	1.579	0.0236	0	0.270

Table. 11. Relative rockfish to halibut catch rates in kilograms by species and rockfish species combined.

All Areas	Quillback	Redbanded	Yelloweye	QB, RB, YE Combined
Mean	0.0023	0.0480	0.0307	0.0810
Standard Error	0.0009	0.0098	0.0064	0.0117
Median	0.0000	0.0000	0.0000	0.0232
Standard Deviation	0.0121	0.1270	0.0822	0.1512
Sample Variance	0.0001	0.0161	0.0067	0.0229
Range	0.1416	0.8426	0.7387	0.8426
Minimum	0.0000	0.0000	0.0000	0.0000
Maximum	0.1416	0.8426	0.7387	0.8426
Total Number of Sets	167	167	167	167
Confidence Level (95.0%)	0.0019	0.0194	0.0126	0.0231

Central Coast	Quillback	Redbanded	Yelloweye	QB, RB, YE Combined
Mean	0.0008	0.0970	0.0278	0.1256
Standard Error	0.0005	0.0238	0.0089	0.0241
Median	0.0000	0.0206	0.0000	0.0636
Standard Deviation	0.0036	0.1830	0.0680	0.1852
Sample Variance	0.0000	0.0335	0.0046	0.0343
Range	0.0250	0.8426	0.4576	0.8426
Minimum	0.0000	0.0000	0.0000	0.0000
Maximum	0.0250	0.8426	0.4576	0.8426
Total Number of Sets	59	59	59	59
Confidence Level (95.0%)	0.0009	0.0477	0.0177	0.0483

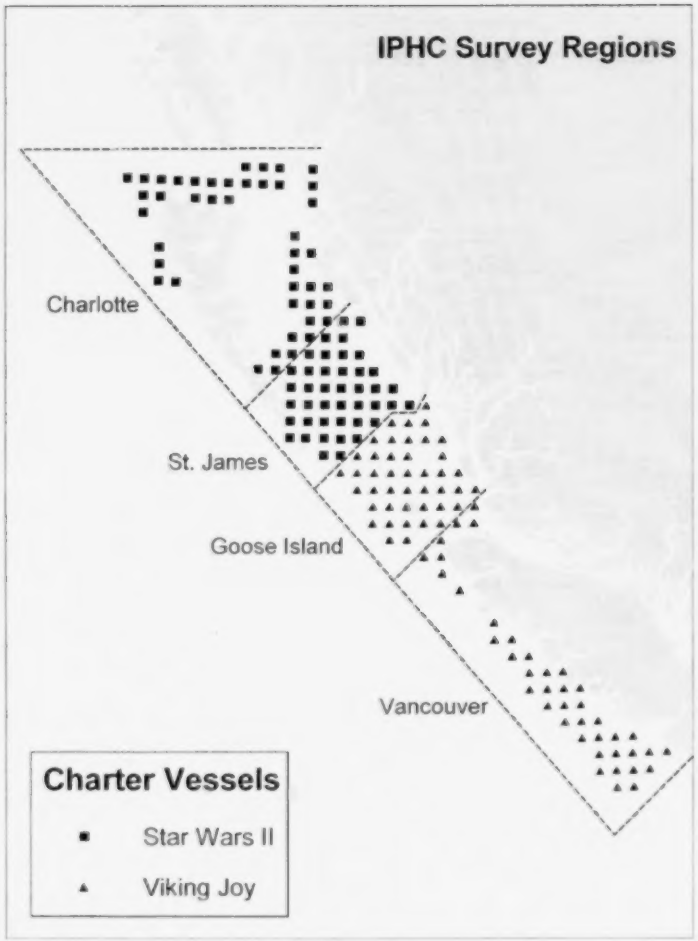
North Coast	Quillback	Redbanded	Yelloweye	QB, RB, YE Combined
Mean	0.0037	0.0061	0.0094	0.0191
Standard Error	0.0016	0.0048	0.0055	0.0079
Median	0.0000	0.0000	0.0000	0.0080
Standard Deviation	0.0057	0.0168	0.0191	0.0275
Sample Variance	0.0000	0.0003	0.0004	0.0008
Range	0.0160	0.0575	0.0614	0.0774
Minimum	0.0000	0.0000	0.0000	0.0000
Maximum	0.0160	0.0575	0.0614	0.0774
Total Number of Sets	12	12	12	12
Confidence Level (95.0%)	0.0036	0.0107	0.0121	0.0175

Queen Charlotte Islands	Quillback	Redbanded	Yelloweye	QB, RB, YE Combined
Mean	0.0007	0.0245	0.0233	0.0485
Standard Error	0.0003	0.0088	0.0071	0.0120
Median	0.0000	0.0000	0.0000	0.0225
Standard Deviation	0.0019	0.0578	0.0464	0.0789
Sample Variance	0.0000	0.0033	0.0022	0.0062
Range	0.0085	0.3117	0.1953	0.3412
Minimum	0.0000	0.0000	0.0000	0.0000
Maximum	0.0085	0.3117	0.1953	0.3412
Total Number of Sets	43	43	43	43
Confidence Level (95.0%)	0.0006	0.0178	0.0143	0.0243

West Coast Vancouver Island	Quillback	Redbanded	Yelloweye	QB, RB, YE combined
Mean	0.0050	0.0219	0.0446	0.0715
Standard Error	0.0029	0.0115	0.0164	0.0219
Median	0.0000	0.0000	0.0000	0.0056
Standard Deviation	0.0208	0.0839	0.1192	0.1596
Sample Variance	0.0004	0.0070	0.0142	0.0255
Range	0.1416	0.5442	0.7387	0.7387
Minimum	0.0000	0.0000	0.0000	0.0000
Maximum	0.1416	0.5442	0.7387	0.7387
Total Number of Sets	53	53	53	53
Confidence Level (95.0%)	0.0057	0.0231	0.0329	0.0440

Table 12. Simulation input parameters derived from the IPHC SSA catch data by species including the proportion of sets with zero catch (P), the mean density (kg/km^2) of nonzero sets (μ), and the catch rate coefficient of variation of nonzero sets (ρ).

Species	P	μ	ρ
Quillback rockfish	0.8235	17.7098	0.8484
Redbanded rockfish	0.5824	146.7619	1.7881
Yelloweye rockfish	0.5824	188.5987	1.4492



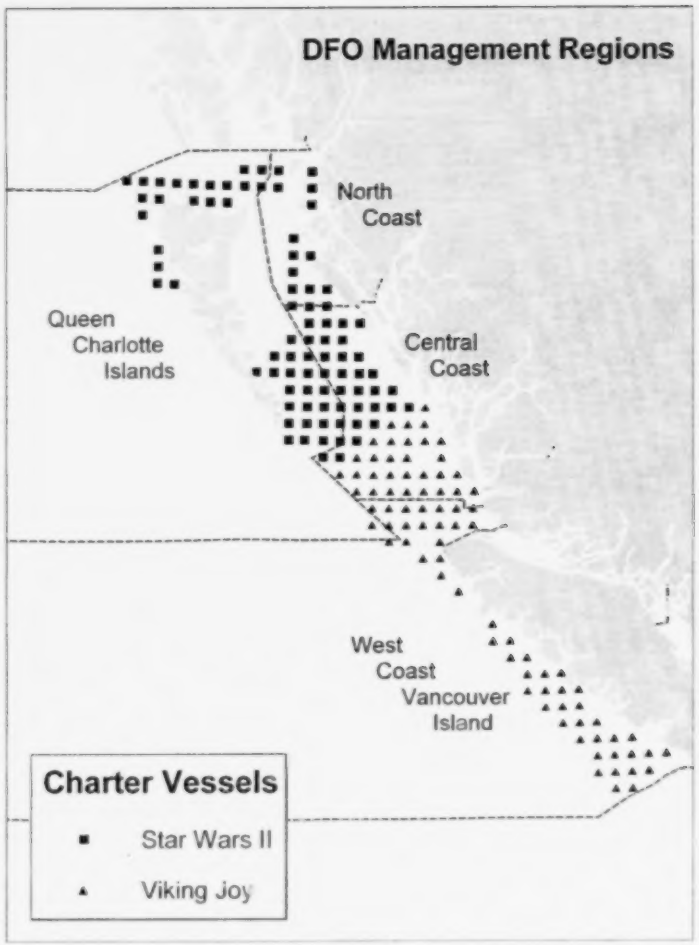


Figure. 1. IPHC survey station locations, IPHC survey regions (left panel) and DFO management regions (right panel).

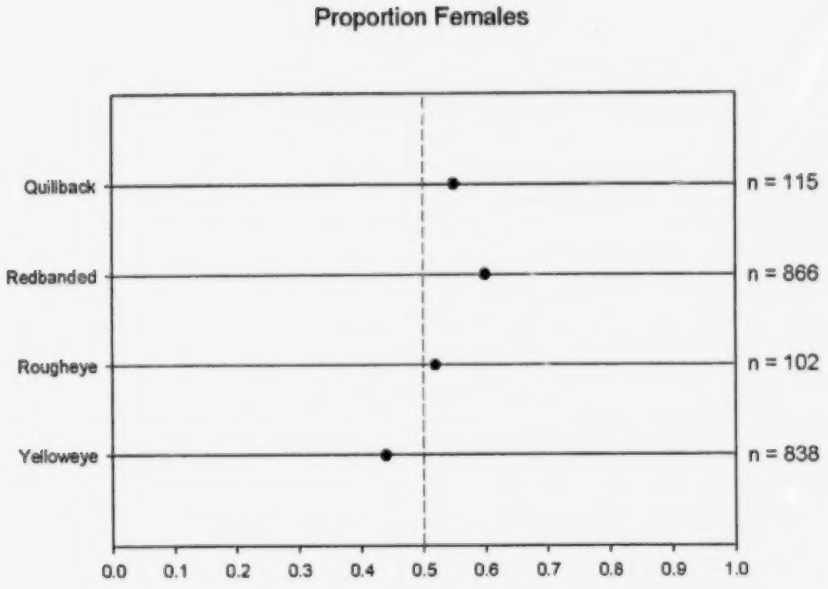


Figure 2. Proportion females for rockfish commonly caught on the survey with sample size (n).

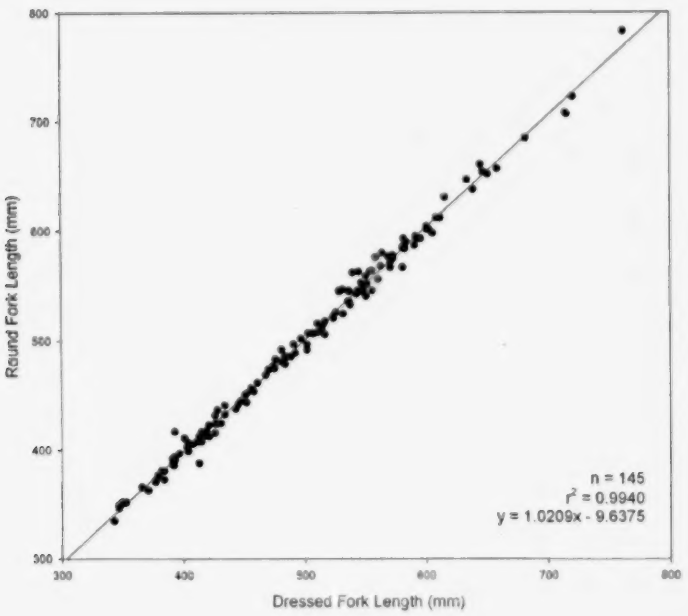


Figure. 3 . Linear regression fit to dressed and round fork length data.

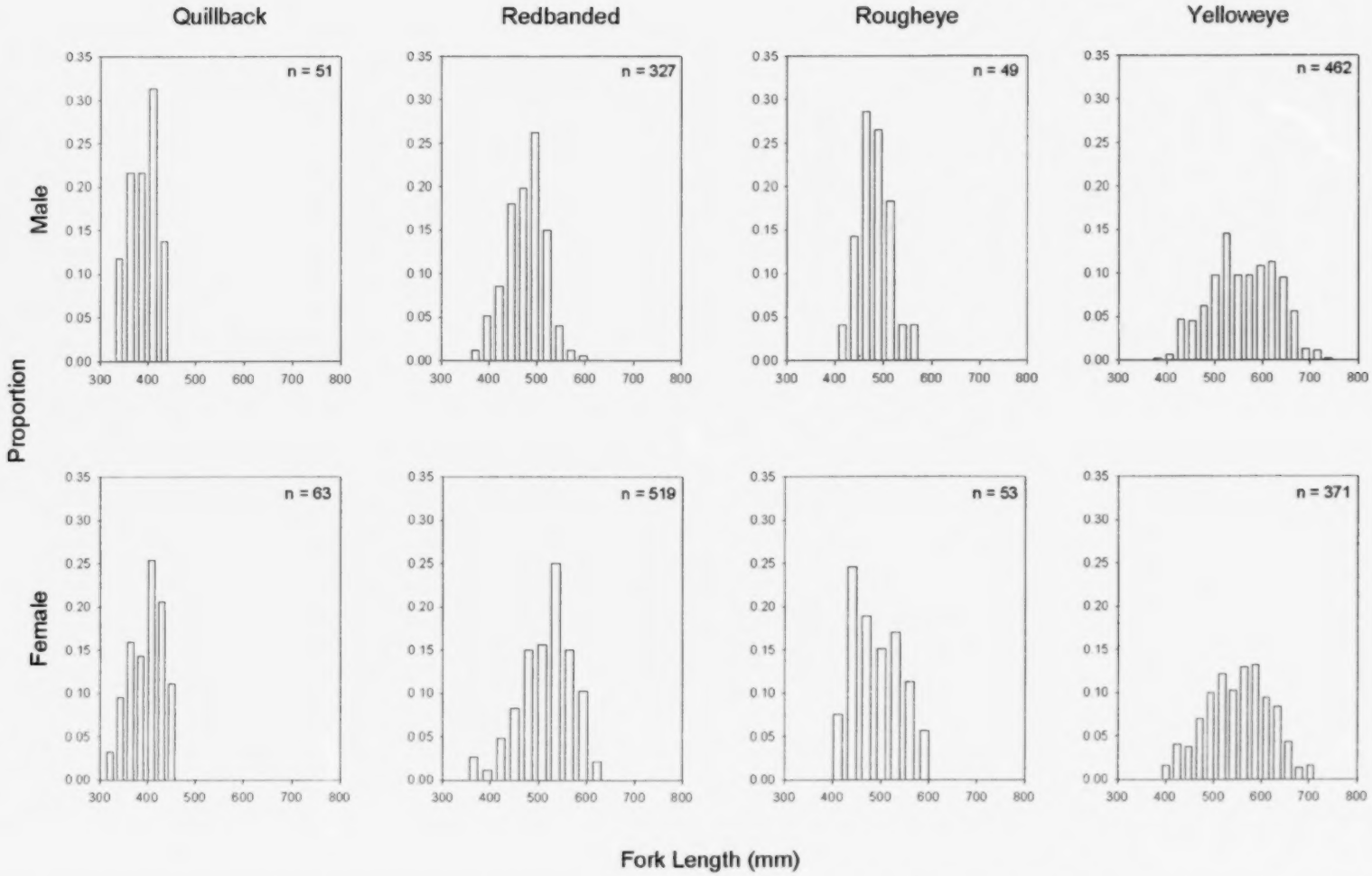


Figure. 4. Length frequency distributions for quillback, redbanded, rougheye and yelloweye rockfishes. Males in the upper panels and females in the lower panels with sample sizes (n).

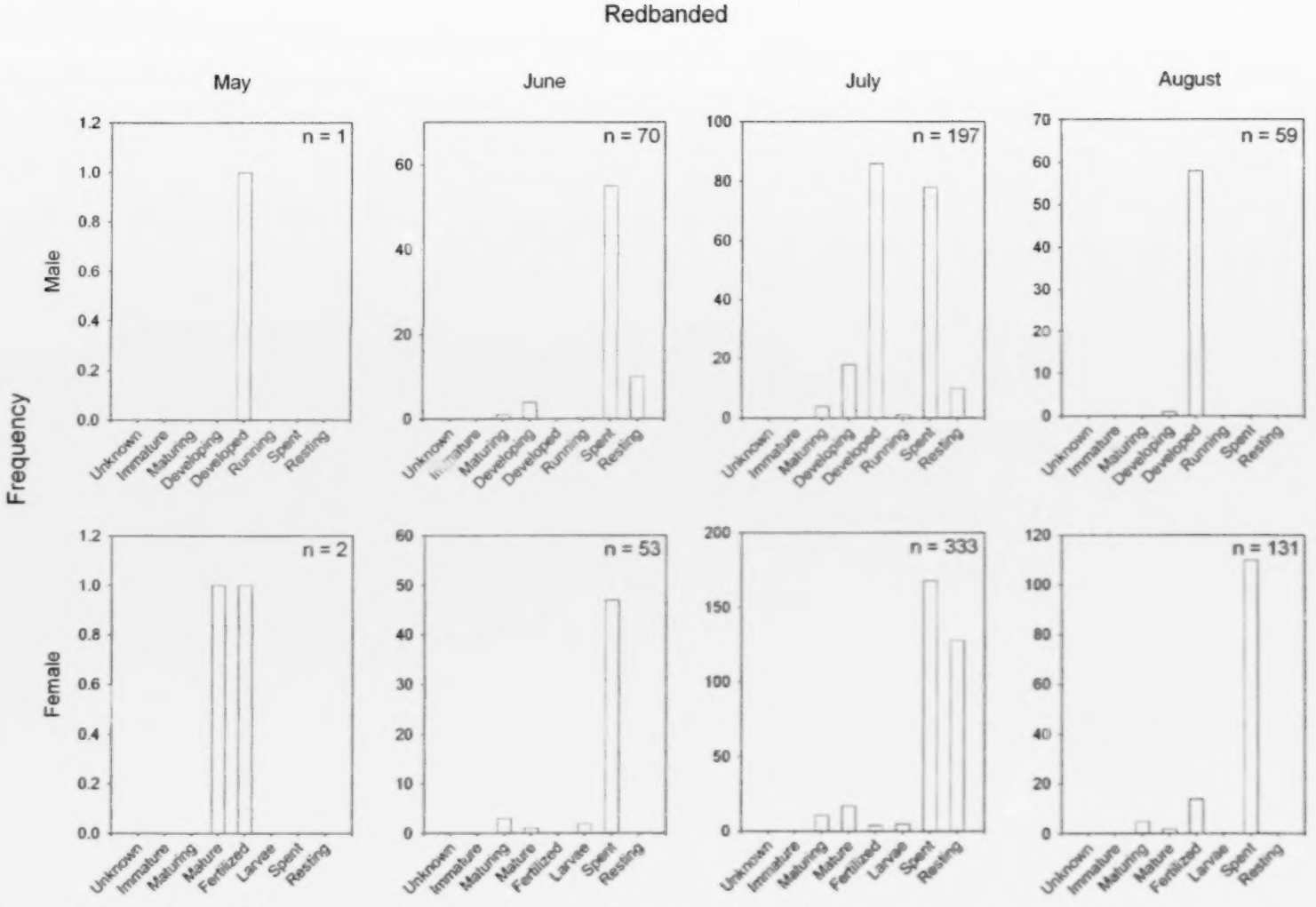


Figure. 5. Redbanded rockfish maturity frequency by sex and month with sample sizes (n).

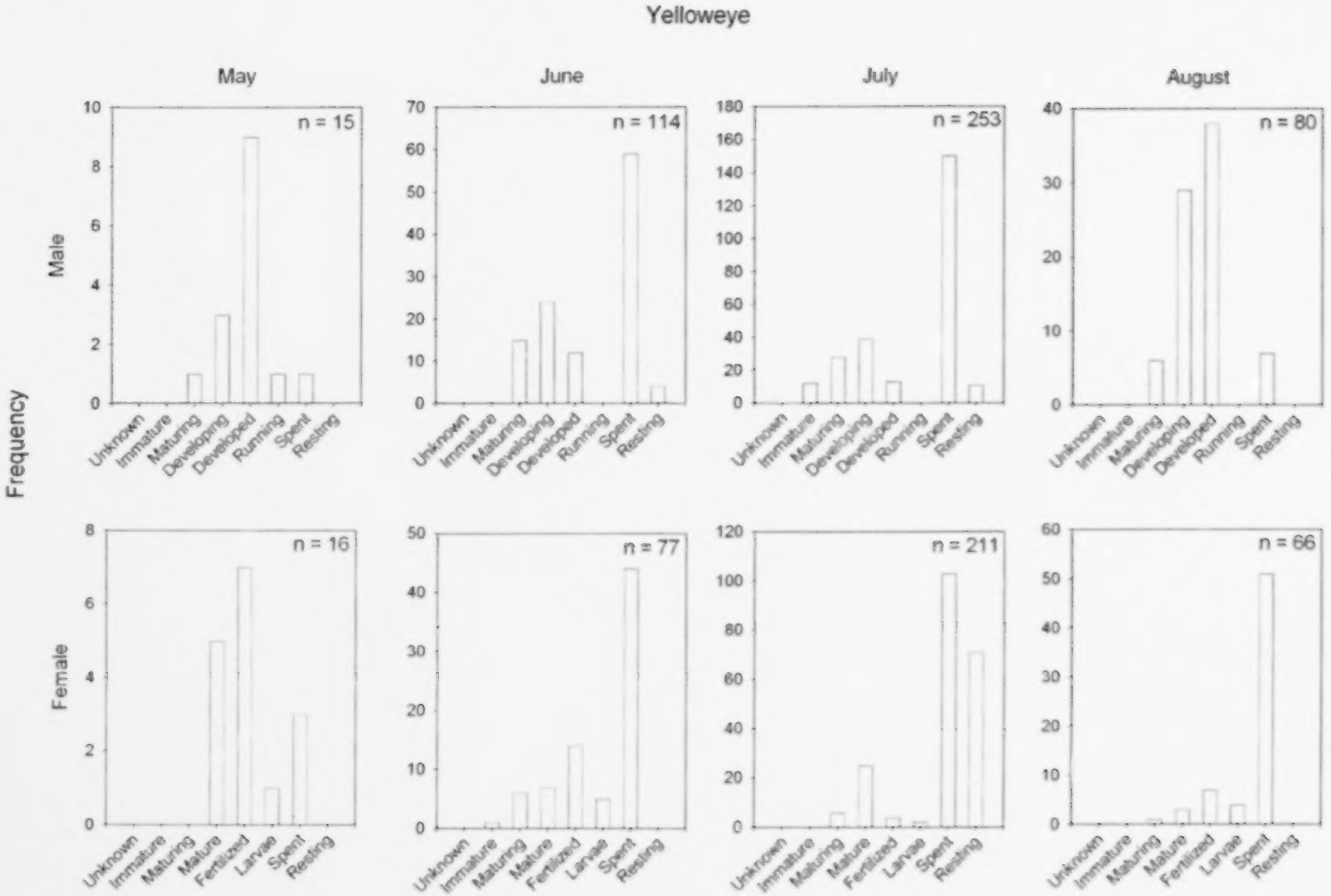


Figure. 6. Yelloweye rockfish maturity frequencies by sex and month with sample sizes (n).

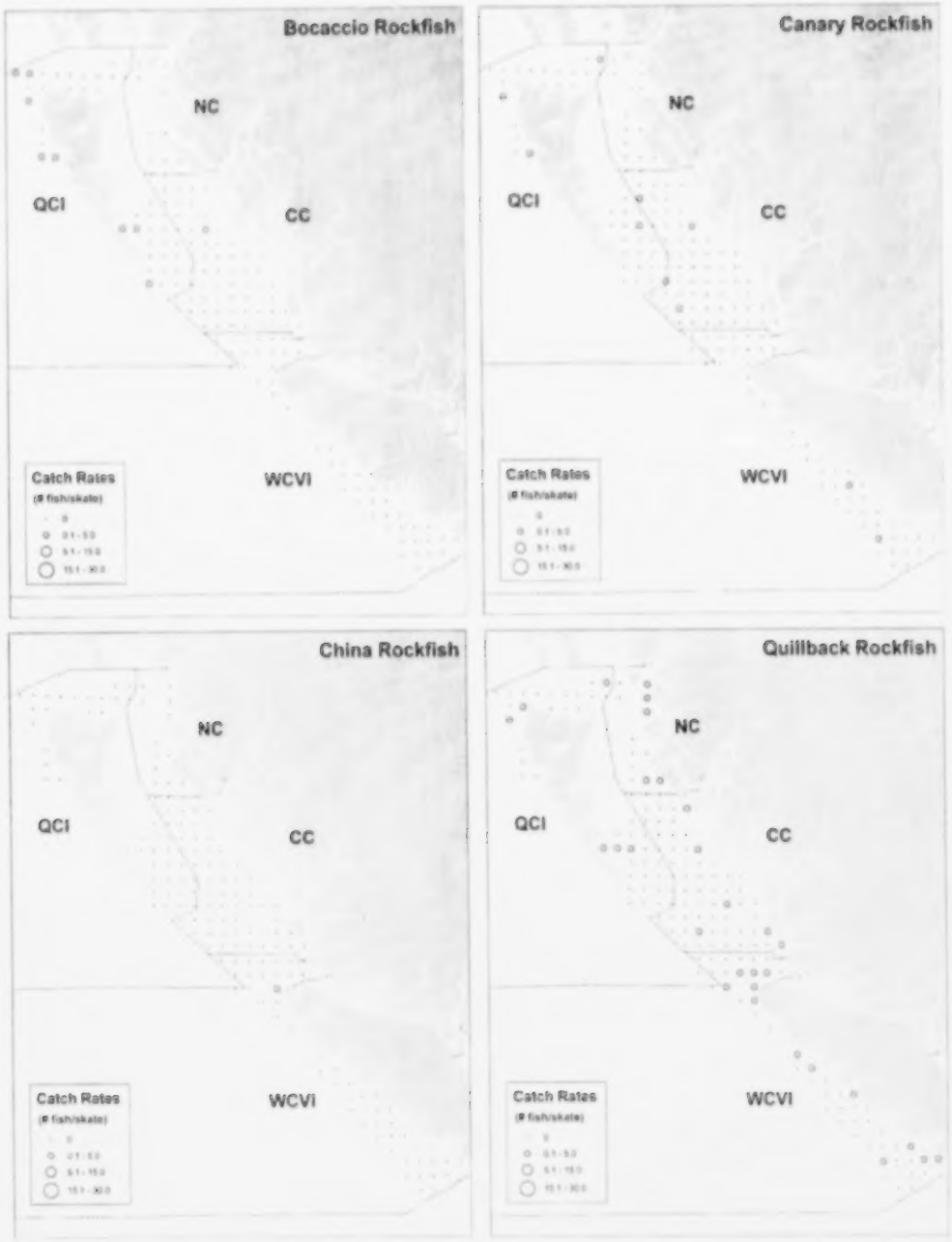


Figure. 7. Spatial distribution of catch rate in numbers of fish per skate for rockfishes and sablefish. The common name of the species appears in the upper right corner of the panel.

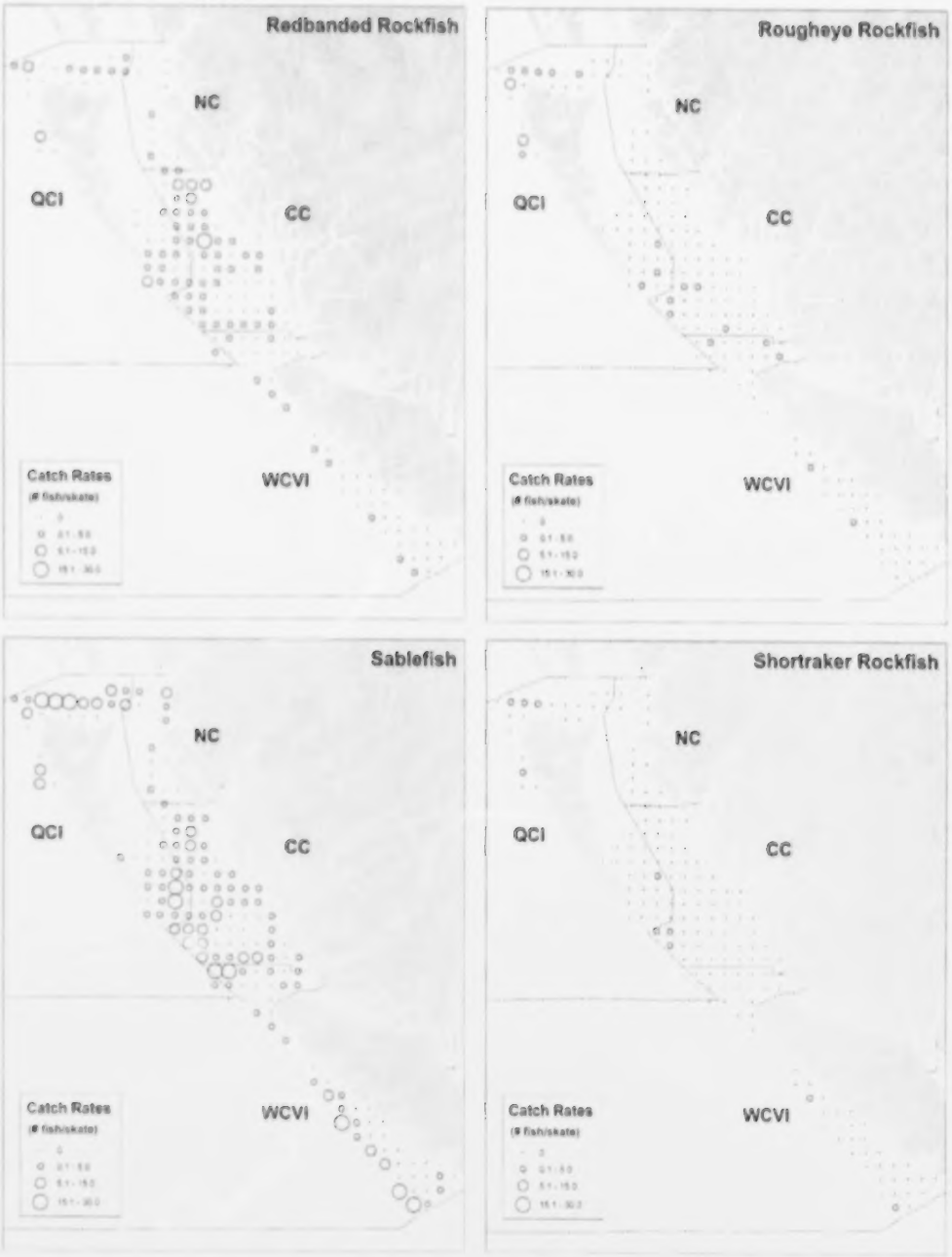


Figure. 7. continued.

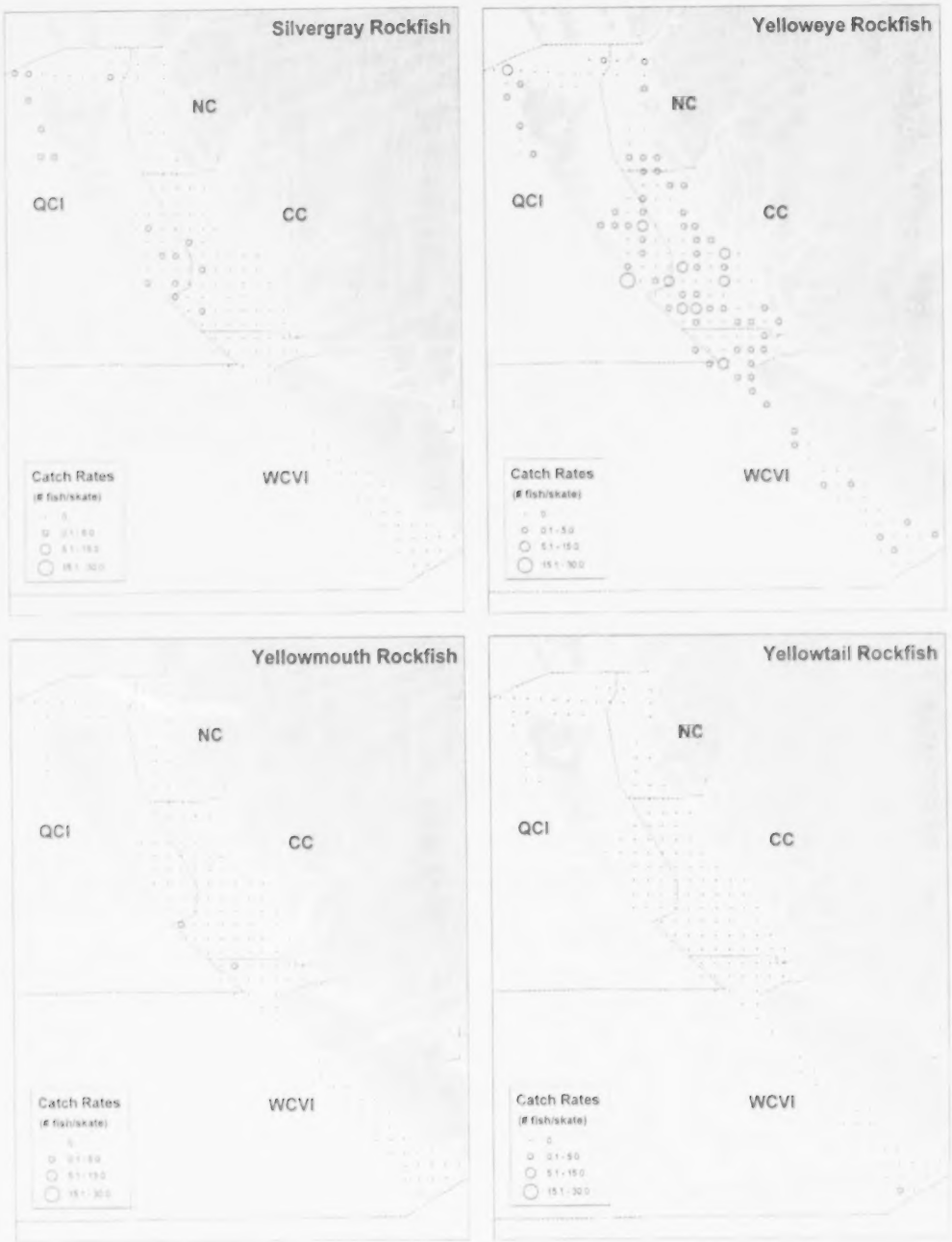


Figure. 7. continued.

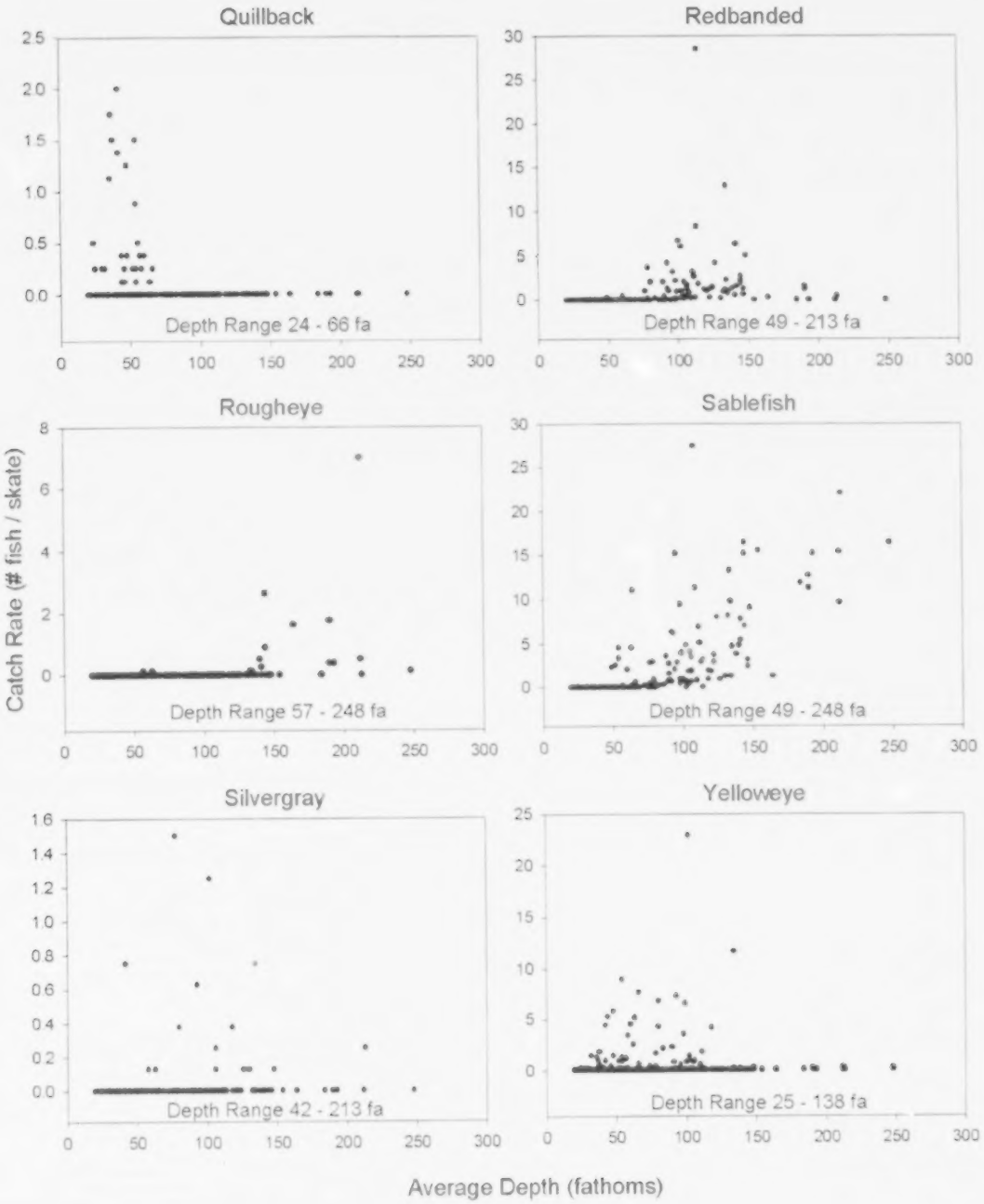


Figure 8. Relationships between catch rate and average depth for sets where the difference between the minimum and maximum depth was not greater than 50 fathoms.

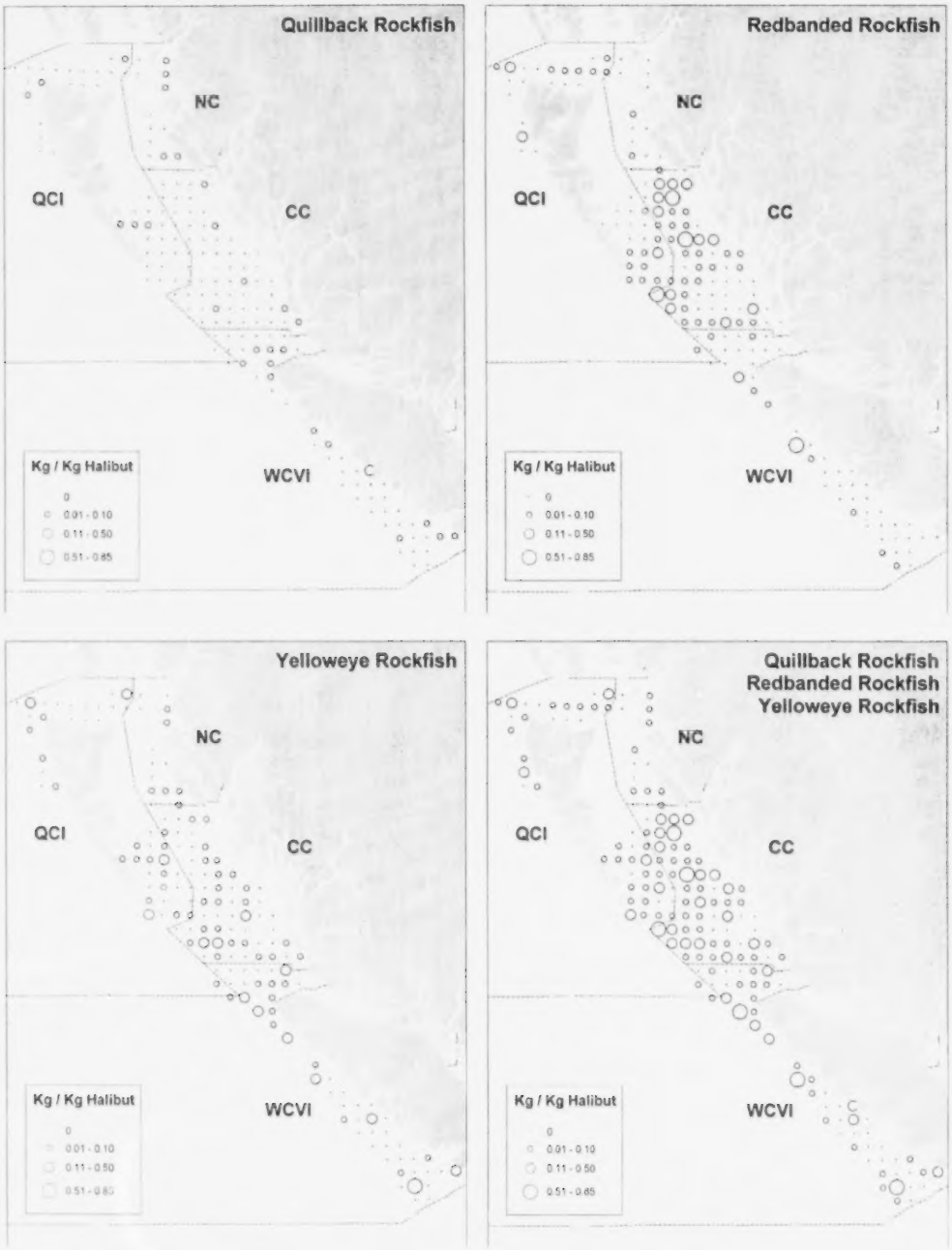


Figure. 9. Spatial distribution of the relative catch rate in kilograms per skate of rockfish to halibut for quillback (upper left panel), redbanded (upper right panel) and yelloweye (lower left panel) rockfishes and for these rockfish combined (lower right panel).

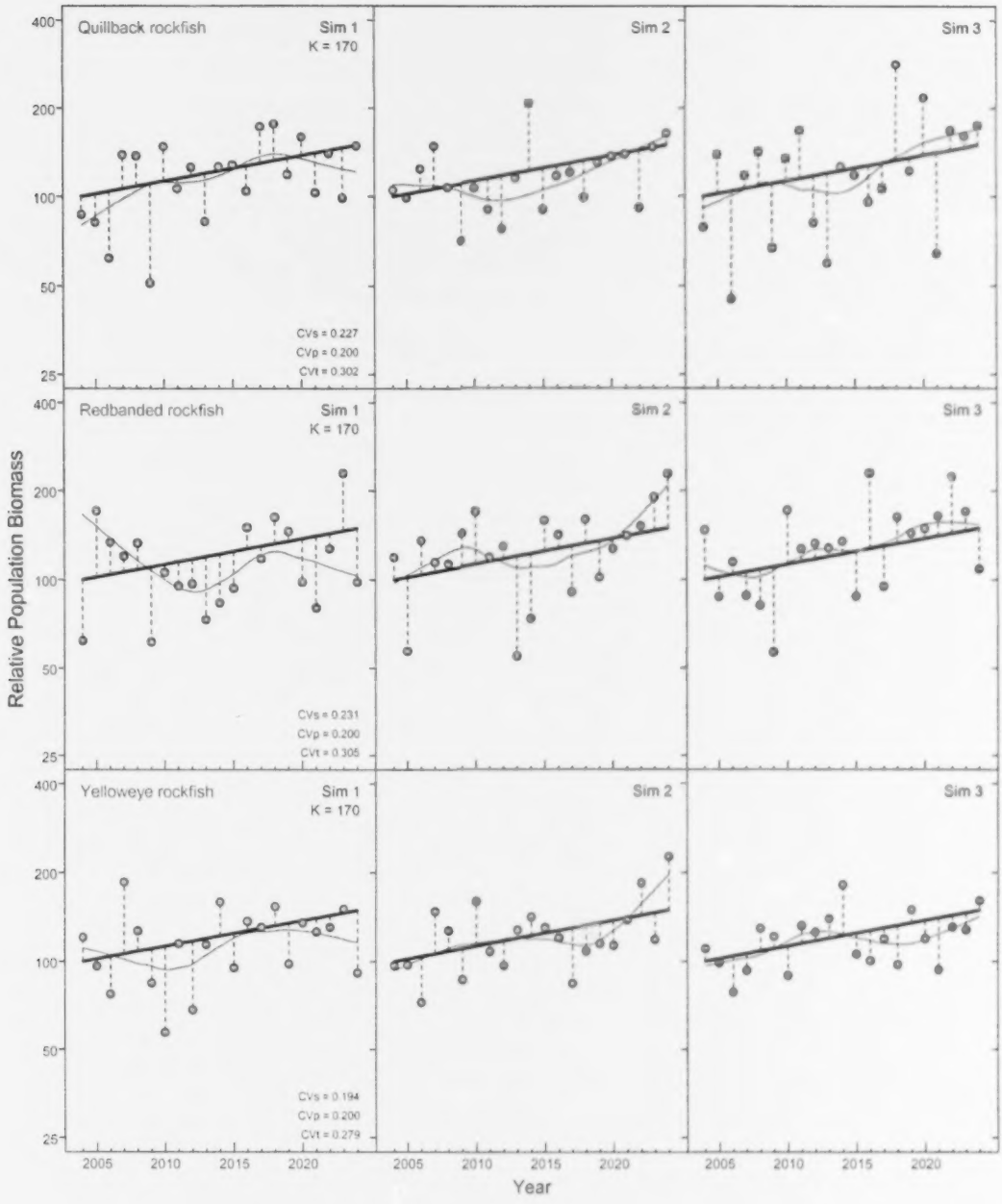


Figure. 10. Pessimistic simulation results showing the known population growth rate at 2% compounded per year (solid line), biomass estimates (circles) include process error of 0.20. Departures of the biomass estimates from the known population (vertical dashed lines) are shown with a loess line (thin lines). Coefficients of variation are shown for the survey (CVs), process (CV_p) and total (CV_t).

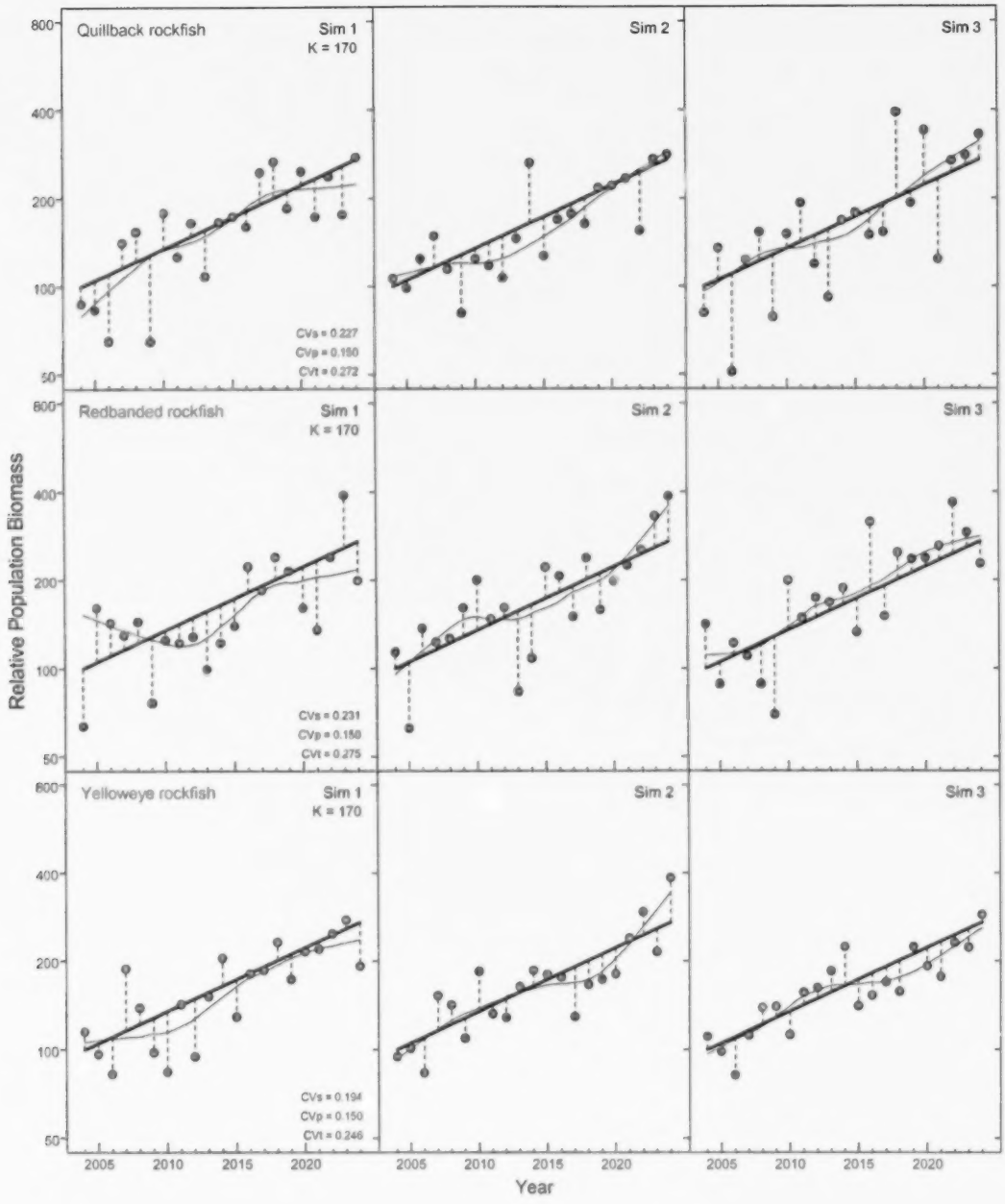


Figure. 11. Optimistic simulation scenario with the known population growth rate at 5% compounded per year (solid line), biomass estimates (circles) include process error of 0.15. Departures of the biomass estimates from the known population (vertical dashed lines) are shown with a loess line (thin lines). Coefficients of variation are shown for the survey (CVs), process (CV_p) and total (CV_t).

Appendix A.

Memorandum of Understanding Between the International Pacific Halibut Commission (Seattle, WA) and Fisheries and Oceans Canada (Nanaimo, B.C.) for the collection and use of bycatch data, and the revenue sharing of bycatch proceeds obtained during 2003 IPHC Setline Stock Assessment surveys in British Columbia

I BACKGROUND

The annual International Pacific Halibut Commission (hereafter, "the Commission") stock assessment survey represents one of the most extensive research programs conducted in the Northeast Pacific Ocean. Due to the large geographical range, outside agencies often express interest in collaborative research utilizing the Commission survey vessels. Fisheries and Oceans Canada (DFO) manages the rockfish and sablefish fisheries in British Columbia. In order to better understand these fisheries the Commission has agreed to provide the opportunity to deploy one contract observer, at the request of DFO, aboard each chartered survey vessel in British Columbia to collect both hook by hook species identification data and ancillary data on catch other than halibut during survey operations. In order to facilitate a comprehensive examination of the resulting data, in a manner that expands the scientific scope of this project, the above parties enter into the following agreement regarding the use of any hook by hook species identification and ancillary data obtained. This agreement shall also describe the conditions under which the Commission agrees to the placement of the observer contracted through DFO and the sharing of the revenue from the sale of rockfish, Pacific cod, and sablefish retained by the charter survey vessels during the survey.

II AUTHORITIES AND POLICIES

This Memorandum is established between Fisheries and Oceans Canada and the International Pacific Halibut Commission. Both DFO and the Commission shall have the right to publish reports or analyses based on the data collected under the provisions of this MOU. If an individual of either agency is not an author of the publications arising from these data, the contribution of the other agency shall be duly acknowledged in the publication.

DFO will issue the necessary permits for the charter vessel to retain, sample, process, and sell Pacific cod, rockfish, and sablefish. No undersized sablefish will be retained or delivered during the Commission charter.

The Commission will have no financial obligation to the non-Commission employee(s) contracted through DFO (hereafter, contracted observer)for the work conducted under this agreement. DFO has agreed to arrange the payment of all expenses related to this project.

III INDIVIDUAL RESPONSIBILITIES

A. Data sharing

1. It is understood that a contracted observer will work aboard the Commission survey vessels to collect hook by hook species identification and ancillary data on catch other than halibut during survey operations.

2. It is understood that the data obtained by both the contracted observer and Commission staff will be made available to DFO and the Commission for use in publications and research. The hook by hook species identification data will be submitted to the Commission in an electronic format and the companion Commission data will be made available to DFO within six months of the survey completion.

B. Conditions required to carry the contracted observer

1. The Commission requires that vessels undergo a safety inspection in their respective country before charter and staff members personally inspect the vessels. Even in light of inspections and training that the contracted observers may have, the nature of the work dictates that a mishap at sea is still possible and may require the contracted observer to perform duties not normally expected, such as occupying a particular safety station aboard the vessel, donning a survival suit and boarding a life raft, and/or participating in various rescue practices by boat or helicopter.

2. The Commission agrees to provide assistance at any time if the contracted observer feels threatened or harassed and may include but is not limited to: speaking to captain/crew, Commission staff, and the contracted observer via means available, ordering the vessel to the nearest port, dismissing offending party(s), terminating the charter, or contacting the proper enforcement agency if in immediate danger.

3. The contracted observer agrees to comply with all of the rules and regulations of the Commission as stated in the International Pacific Halibut Commission 2003 Stock Assessment Survey Manual. In addition they shall abide by the directions of the Commission staff supervising the sampling operations.

4. The contracted observer will be currently certified in survival at sea emergency procedures.

5. The contracted observer will be responsible for transportation and accommodation to and from the vessel.

6. DFO will pay $35 (U.S.) per day to the Commission for expenses incurred by the charter vessel for carrying a third biologist.

C. Revenue sharing

1. DFO will pay the Commission for any loss of revenue to rockfish due to the sampling procedures. Market value of round rockfish will be established by the Commission as a component of the standard competitive bidding process on the sale of fish from each survey trip landing. Fifty percent (50%) of the market value from rockfish sales will go to the charter vessel for handling costs and the Commission will retain the remaining portion. The Commission shall apply this remaining revenue to costs incurred in the provision of commercial fishery catch data, other than halibut, reported through Commission logbooks to DFO.

2. Fifty percent (50%) of the market value from Pacific cod sales will go to the charter vessel for handling costs and the Commission will retain the remaining portion. The Commission shall apply this remaining revenue to costs incurred in the provision of commercial fishery catch data, other than halibut, reported through Commission logbooks to DFO.

3. The Commission will pay the Canadian Sablefish Association 50% of the proceeds from legal-sized, non-quota sablefish. This portion of the proceeds shall offset the entire cost of the contracted observer for all parties contributing to this project. The remaining 50% will be paid to the charter vessel for handling costs.

IV HOLD HARMLESS CLAUSE

Each party agrees that it will be responsible for its own acts and the results thereof and shall not be responsible for the acts of the other parties thereof. To the extent authorized by law, the Commission agrees to indemnify and hold DFO harmless for any loss, damage, liability, cost or expense to the person or property which was caused by the negligence of the Commission, its officers, employees, and agents, under this Memorandum.

V APPROVALS

Signature	Date
Bruce Leaman Executive Director **International Pacific Halibut Commission** PO Box 95009 Seattle, Washington 98145-2009	

Signature	Date
Lynne Yamanaka Scientific Authority **Department of Fisheries and Oceans** Pacific Biological Station Nanaimo, BC V9T 6N7	

Appendix Table 1. Description of sexual maturity stages for rockfish, based on Westrheim (1975).

Maturity Stage	Males
Immature	translucent pink, threadlike
Maturing	stringlike, slight swelling, translucent
Developing	swelling, brown-white
Developed	large, white; easily broken
Running	running sperm
Spent	white-brown; sperm still in duct
Resting	triangluar in cross-section; small, brown

Maturity Stage	Females
Immature	translucent pink, small
Maturing	small, yellow eggs, translucent or opaque
Mature	large, yellow or orange eggs; opaque
Fertilized	large, orange-yellow eggs; translucent
Embryos or Larvae	include eyed eggs; translucent
Spent	large, flaccid, red ovaries; a few larvae may be present
Resting	moderate size, firm, orange-grey ovaries, some with dark blotches

Appendix Table 2. Summary of fishing data by vessel, set number, date, location (start and end latitudes and longitudes in degrees, decimal minutes) and depth (minimum, maximum and average in fathoms).

Viking Joy

Set No.	Date	Start Latitude	Start Longitude	End Latitude	End Longitude	Min. Depth (fa)	Max Depth (fa)	Avg. Depth (fa)
1	27-May-03	4840.02	12509.01	4838.09	12506.03	36	38	37
2	27-May-03	4839.80	12522.40	4841.70	12524.70	33	81	57
3	28-May-03	4829.50	12521.79	4831.04	12524.21	50	81	66
4	28-May-03	4829.55	12536.96	4830.78	12540.08	49	57	53
5	28-May-03	4819.34	12537.07	4821.47	12538.62	76	80	78
6	29-May-03	4819.34	12551.03	4820.69	12553.31	96	189	142
7	29-May-03	4829.08	12606.69	4830.78	12608.60	107	108	108
8	29-May-03	4828.90	12551.88	4831.03	12553.58	51	65	58
9	31-May-03	4849.30	12534.75	4850.52	12537.56	23	27	25
10	31-May-03	4840.86	12537.62	4838.77	12538.20	33	92	62
11	31-May-03	4838.98	12553.43	4841.12	12552.10	38	46	42
12	01-Jun-03	4840.82	12608.92	4838.97	12607.13	30	34	32
13	01-Jun-03	4850.66	12609.20	4848.75	12606.58	77	80	78
14	01-Jun-03	4850.84	12551.94	4848.65	12553.25	59	61	60
15	04-Jun-03	4859.81	12607.37	4900.72	12610.38	37	42	40
16	04-Jun-03	4849.15	12622.30	4850.08	12625.27	97	98	98
17	04-Jun-03	4859.21	12621.74	4900.79	12624.06	75	76	76
18	05-Jun-03	4909.76	12636.06	4910.62	12639.04	63	70	66
19	05-Jun-03	4859.81	12634.46	4900.18	12639.61	108	185	146
20	05-Jun-03	4910.76	12653.35	4908.84	12651.29	92	95	94
21	06-Jun-03	4910.31	12624.38	4908.39	12622.24	51	51	51
22	06-Jun-03	4919.16	12620.06	4920.67	12621.99	20	23	22
23	06-Jun-03	4919.48	12636.13	4920.34	12639.17	34	42	38
24	11-Jun-03	4929.91	12637.77	4931.05	12640.55	22	26	24
25	11-Jun-03	4919.71	12651.53	4920.60	12654.55	73	79	76
26	11-Jun-03	4929.08	12651.05	4930.82	12653.64	48	51	50
27	15-Jun-03	4919.60	12707.44	4921.12	12709.38	93	97	95
28	15-Jun-03	4930.83	12709.83	4928.59	12708.17	78	80	79
29	16-Jun-03	4939.80	12707.48	4940.40	12710.91	62	65	64
30	16-Jun-03	4939.33	12722.84	4940.55	12725.35	88	208	148
31	17-Jun-03	4949.36	12722.52	4950.36	12725.81	41	47	44
32	17-Jun-03	4949.34	12738.55	4950.19	12741.72	89	102	96
33	17-Jun-03	4959.00	12739.20	5000.76	12741.36	43	49	46
34	20-Jun-03	5019.18	12809.88	5018.65	12812.72	87	92	90
35	20-Jun-03	5032.32	12828.08	5029.14	12825.25	102	103	102
36	21-Jun-03	5039.50	12826.11	5040.22	12829.16	42	50	46
37	21-Jun-03	5039.44	12842.23	5040.00	12845.39	104	109	106
38	21-Jun-03	5049.33	12827.23	5050.37	12830.37	26	35	30
39	22-Jun-03	5059.27	12843.55	5100.42	12846.66	35	40	38
40	22-Jun-03	5059.61	12858.05	5100.44	12901.29	42	46	44

Appendix Table 2 continued.

Viking Joy

Set No.	Date	Start Latitude	Start Longitude	End Latitude	End Longitude	Min. Depth (fa)	Max Depth (fa)	Avg. Depth (fa)
41	22-Jun-03	5051.49	12859.31	5048.72	12900.36	40	55	48
42	23-Jun-03	5049.47	12914.09	5050.18	12917.28	60	73	66
43	23-Jun-03	5059.09	12914.07	5100.07	12917.88	84	91	88
44	23-Jun-03	5059.54	12930.30	5100.22	12933.73	127	149	138
45	24-Jun-03	5109.07	12915.93	5111.33	12917.05	124	164	144
46	24-Jun-03	5109.13	12930.80	5111.15	12932.31	154	155	154
47	24-Jun-03	5119.11	12930.25	5121.17	12931.63	92	118	105
48	25-Jun-03	5119.35	12945.24	5120.33	12948.19	130	133	132
49	25-Jun-03	5129.36	12945.77	5130.24	12949.03	91	95	93
50	25-Jun-03	5130.72	13003.31	5129.54	13000.34	139	278	208
51	26-Jun-03	5059.01	12827.19	5100.96	12829.20	50	53	52
52	26-Jun-03	5058.96	12812.37	5100.85	12814.48	41	63	52
53	29-Jun-03	5059.71	12756.04	5100.75	12759.61	52	74	63
54	29-Jun-03	5109.21	12754.70	5109.51	12757.63	61	72	66
55	29-Jun-03	5109.31	12810.83	5110.34	12814.13	53	61	57
56	30-Jun-03	5109.44	12826.09	5109.88	12829.60	103	105	104
57	30-Jun-03	5109.52	12842.21	5110.26	12845.74	52	61	56
58	30-Jun-03	5120.17	12845.10	5119.25	12841.82	101	117	109
59	01-Jul-03	5130.39	12844.91	5130.23	12841.31	24	65	44
60	01-Jul-03	5139.48	12857.08	5140.42	12900.57	25	42	34
61	01-Jul-03	5130.92	12900.08	5129.09	12858.30	23	27	25
62	02-Jul-03	5120.84	12859.76	5118.78	12857.71	132	135	134
63	02-Jul-03	5110.42	12901.22	5109.22	12858.32	69	75	72
64	02-Jul-03	5119.60	12913.37	5120.45	12917.02	111	132	122
65	03-Jul-03	5131.15	12914.41	5128.94	12916.03	26	31	28
66	03-Jul-03	5130.27	12928.11	5129.08	12931.40	46	62	54
67	03-Jul-03	5139.24	12916.93	5140.56	12914.13	28	34	31
68	04-Jul-03	5139.50	12929.34	5140.45	12932.60	49	60	54
69	04-Jul-03	5139.42	12945.57	5140.71	12948.68	105	172	138
70	04-Jul-03	5149.18	12930.66	5150.70	12933.42	136	146	141
71	05-Jul-03	5149.25	12913.58	5151.07	12915.84	67	71	69
72	05-Jul-03	5159.02	12912.91	5200.78	12914.89	97	98	98
73	05-Jul-03	5150.35	12859.45	5149.03	12856.56	38	51	44
74	08-Jul-03	5119.19	12753.47	5120.80	12756.15	56	77	66
75	08-Jul-03	5129.08	12809.83	5130.70	12812.14	45	50	48
76	08-Jul-03	5120.73	12811.34	5118.42	12810.79	29	61	45
77	09-Jul-03	5118.88	12825.60	5120.91	12827.13	70	86	78
78	09-Jul-03	5128.83	12826.66	5130.73	12828.65	102	104	103
79	10-Jul-03	5151.33	12825.73	5149.11	12826.58	86	95	90
80	10-Jul-03	5139.83	12824.44	5141.71	12826.66	78	79	78

Appendix Table 2 continued.

Viking Joy

Set No.	Date	Start Latitude	Start Longitude	End Latitude	End Longitude	Min. Depth (fa)	Max Depth (fa)	Avg. Depth (fa)
81	10-Jul-03	5149.55	12840.17	5150.60	12843.29	57	73	65
82	11-Jul-03	5159.46	12839.64	5201.29	12841.96	86	92	89
83	11-Jul-03	5208.80	12839.87	5210.85	12841.53	104	132	118
84	11-Jul-03	5200.57	12858.37	5158.45	12857.28	58	91	74

Star Wars II

1	05-Jul-03	5148.84	12947.00	5151.06	12947.01	120	159	140
2	05-Jul-03	5151.12	13003.00	5148.81	13003.00	95	103	99
3	05-Jul-03	5141.13	13003.01	5138.73	13003.01	188	192	190
4	06-Jul-03	5138.85	13019.01	5141.06	13019.00	131	164	148
5	06-Jul-03	5148.83	13019.01	5151.17	13019.00	117	120	118
6	06-Jul-03	5151.13	13035.00	5148.92	13035.00	158	170	164
7	07-Jul-03	5148.90	13052.03	5151.25	13052.00	92	112	102
8	07-Jul-03	5156.80	13052.00	5200.92	13052.00	84	119	102
9	07-Jul-03	5201.15	13035.00	5158.94	13034.99	124	167	146
10	08-Jul-03	5208.89	13019.01	5211.44	13019.00	203	223	213
11	08-Jul-03	5158.85	13019.00	5201.39	13019.00	189	197	193
12	08-Jul-03	5208.83	13035.00	5211.22	13035.00	104	108	106
13	09-Jul-03	5228.87	13124.99	5231.16	13125.00	43	166	104
14	09-Jul-03	5228.86	13108.02	5231.29	13108.00	37	90	64
15	09-Jul-03	5238.83	13108.00	5241.31	13108.00	36	46	41
16	10-Jul-03	5208.86	13052.00	5210.81	13052.01	118	123	120
17	10-Jul-03	5218.82	13052.00	5221.13	13052.00	75	83	79
18	10-Jul-03	5218.83	13035.01	5221.11	13035.00	88	94	91
19	13-Jul-03	5311.09	13018.00	5308.62	13018.00	55	119	87
20	13-Jul-03	5301.18	13018.00	5258.74	13018.02	112	114	113
21	13-Jul-03	5258.86	13035.01	5301.01	13035.00	46	52	49
22	14-Jul-03	5250.98	13035.02	5248.34	13035.02	59	65	62
23	14-Jul-03	5251.03	13052.10	5248.56	13052.01	24	29	26
24	14-Jul-03	5241.14	13052.00	5238.86	13052.00	48	52	50
25	15-Jul-03	5231.12	13052.01	5228.63	13052.00	56	60	58
26	15-Jul-03	5231.18	13034.99	5228.57	13035.00	63	69	66
27	15-Jul-03	5241.12	13034.99	5238.67	13035.00	76	90	83
28	16-Jul-03	5251.15	13019.01	5248.82	13019.00	114	115	114
29	16-Jul-03	5241.13	13019.00	5238.81	13019.00	120	123	122
30	16-Jul-03	5241.16	13002.00	5239.00	13002.00	144	145	144
31	17-Jul-03	5241.16	12946.00	5238.86	12946.00	102	119	110
32	17-Jul-03	5231.16	12946.01	5228.72	12946.00	90	107	98
33	17-Jul-03	5231.16	13002.00	5228.99	13002.00	144	149	146
34	18-Jul-03	5248.83	13002.00	5251.23	13002.00	140	142	141
35	18-Jul-03	5258.82	13002.00	5301.07	13002.00	79	120	100
36	18-Jul-03	5301.15	12945.00	5258.71	12945.00	29	140	84

Appendix Table 2 continued.

Star Wars II

Set No.	Date	Start Latitude	Start Longitude	End Latitude	End Longitude	Min. Depth (fa)	Max Depth (fa)	Avg. Depth (fa)
37	22-Jul-03	5328.92	13306.00	5331.19	13306.00	137	278	208
38	22-Jul-03	5318.86	13306.01	5321.03	13306.00	116	205	160
39	22-Jul-03	5318.83	13249.00	5320.98	13249.00	75	82	78
40	23-Jul-03	5338.82	13307.01	5341.09	13307.01	77	84	80
41	23-Jul-03	5358.41	13325.00	5401.10	13325.00	39	46	42
42	24-Jul-03	5408.85	13309.00	5411.24	13309.01	27	46	36
43	24-Jul-03	5418.85	13309.01	5421.13	13309.00	247	250	248
44	24-Jul-03	5421.17	13252.00	5419.02	13252.00	208	215	212
45	25-Jul-03	5418.84	13326.01	5421.11	13326.00	115	152	134
46	25-Jul-03	5421.11	13343.00	5418.83	13343.00	127	134	130
47	25-Jul-03	5408.89	13326.00	5411.10	13326.00	211	214	212
48	26-Jul-03	5421.11	13235.01	5418.74	13235.00	139	150	144
49	26-Jul-03	5411.10	13234.00	5408.84	13234.00	41	52	46
50	26-Jul-03	5408.81	13217.00	5411.09	13217.01	38	57	48
51	27-Jul-03	5408.88	13200.00	5411.21	13200.01	21	49	35
52	27-Jul-03	5418.83	13201.00	5421.06	13201.01	126	140	133
53	27-Jul-03	5421.17	13218.00	5418.89	13218.00	114	134	124
54	30-Jul-03	5430.92	13035.01	5428.54	13035.00	55	73	64
55	30-Jul-03	5421.98	13035.01	5418.74	13035.00	41	67	54
56	30-Jul-03	5411.17	13035.01	5408.85	13035.00	42	67	54
57	31-Jul-03	5351.11	13052.01	5348.68	13052.00	44	54	49
58	31-Jul-03	5341.09	13052.00	5338.59	13051.95	27	28	28
59	31-Jul-03	5341.07	13035.00	5338.72	13035.00	16	23	20
60	01-Aug-03	5331.17	13052.00	5328.75	13052.00	49	56	52
61	01-Aug-03	5321.15	13052.00	5318.69	13052.00	72	81	76
62	01-Aug-03	5311.18	13052.00	5308.77	13052.01	56	58	57
63	02-Aug-03	5308.86	13035.00	5311.06	13035.00	99	108	104
64	02-Aug-03	5318.86	13034.99	5321.05	13035.00	41	67	54
65	02-Aug-03	5321.13	13018.00	5318.88	13018.00	49	64	56
66	03-Aug-03	5418.87	13126.00	5421.22	13126.00	79	106	92
67	03-Aug-03	5418.85	13143.00	5421.05	13143.00	99	113	106
68	03-Aug-03	5428.86	13144.00	5430.98	13144.00	180	187	184
69	04-Aug-03	5431.15	13125.99	5428.85	13126.00	41	78	60
70	04-Aug-03	5431.12	13109.00	5428.74	13109.00	72	81	76
71	04-Aug-03	5420.92	13109.00	5418.74	13109.00	32	38	35
72	07-Aug-03	5231.19	13019.00	5229.00	13019.00	125	145	135
73	07-Aug-03	5221.13	13018.99	5218.93	13019.00	185	195	190
74	07-Aug-03	5218.86	13003.00	5221.10	13003.00	117	136	126
75	08-Aug-03	5211.24	13003.00	5208.98	13003.01	83	90	86
76	08-Aug-03	5201.20	13003.00	5159.01	13003.00	74	76	75
77	08-Aug-03	5158.84	12947.01	5201.13	12947.00	62	64	63

Appendix Table 2 continued.

Star Wars II

Set No.	Date	Start Latitude	Start Longitude	End Latitude	End Longitude	Min. Depth (fa)	Max Depth (fa)	Avg. Depth (fa)
78	09-Aug-03	5201.10	12930.00	5158.62	12930.00	106	116	111
79	09-Aug-03	5208.84	12930.00	5211.05	12930.01	111	114	112
80	09-Aug-03	5208.86	12945.99	5211.23	12946.00	99	114	106
81	10-Aug-03	5221.27	12945.99	5218.83	12946.00	111	116	114
82	10-Aug-03	5221.06	12930.00	5218.72	12930.00	82	101	92
83	10-Aug-03	5228.85	12932.00	5231.35	12932.00	26	59	42
84	11-Aug-03	5221.10	12913.00	5218.70	12913.00	68	87	78
85	11-Aug-03	5211.18	12914.00	5208.91	12914.00	87	94	90
86	11-Aug-03	5208.86	12857.00	5211.21	12857.00	66	95	80

Appendix Table 3. Summary by vessel and set of fishing gear deployment, retrieval and soak times.

Viking Joy

Set#	Deploy Gear	Start Retrieval	End Retrieval	Soak Time (hrs)
1	5:02:00 AM	10:10:00 AM	12:44:00 PM	5.13
2	7:03:00 AM	2:05:00 PM	4:40:00 PM	7.03
3	5:08:00 AM	10:25:00 AM	12:32:00 PM	5.28
4	6:26:00 AM	2:10:00 PM	4:10:00 PM	7.73
5	8:23:00 AM	5:07:00 PM	7:23:00 PM	8.73
6	5:13:00 AM	10:30:00 AM	1:07:00 PM	5.28
7	6:58:00 AM	2:40:00 PM	5:05:00 PM	7.70
8	8:43:00 AM	6:27:00 PM	8:32:00 PM	9.73
9	5:05:00 AM	10:24:00 AM	12:32:00 PM	5.32
10	6:45:00 AM	1:48:00 PM	3:53:00 PM	7.05
11	8:15:00 AM	5:07:00 PM	7:17:00 PM	8.87
12	5:00:00 AM	10:14:00 AM	12:16:00 PM	5.23
13	6:47:00 AM	1:53:00 PM	3:58:00 PM	7.10
14	8:32:00 AM	5:02:00 PM	7:15:00 PM	8.50
15	5:24:00 AM	10:44:00 AM	12:52:00 PM	5.33
16	7:20:00 AM	2:29:00 PM	4:51:00 PM	7.15
17	8:51:00 AM	6:00:00 PM	8:01:00 PM	9.15
18	5:05:00 AM	10:15:00 AM	12:55:00 PM	5.17
19	6:41:00 AM	2:06:00 PM	4:35:00 PM	7.42
20	8:42:00 AM	6:00:00 PM	8:12:00 PM	9.30
21	4:58:00 AM	10:06:00 AM	12:23:00 PM	5.13
22	6:31:00 AM	1:29:00 PM	3:52:00 PM	6.97
23	7:48:00 AM	5:00:00 PM	7:31:00 PM	9.20
24	4:46:00 AM	9:48:00 AM	11:58:00 AM	5.03
25	6:46:00 AM	1:33:00 PM	3:57:00 PM	6.78
26	8:03:00 AM	4:58:00 PM	7:07:00 PM	8.92
27	7:20:00 AM	12:25:00 PM	2:54:00 PM	5.08
28	8:54:00 AM	4:20:00 PM	6:34:00 PM	7.43
29	5:10:00 AM	10:33:00 AM	12:49:00 PM	5.38
30	6:25:00 AM	2:13:00 PM	4:55:00 PM	7.80
31	4:43:00 AM	9:43:00 AM	11:58:00 AM	5.00
32	6:00:00 AM	1:12:00 PM	3:22:00 PM	7.20
33	7:21:00 AM	4:42:00 PM	7:04:00 PM	9.35
34	5:42:00 AM	10:55:00 AM	1:08:00 PM	5.22
35	7:46:00 AM	2:51:00 PM	5:08:00 PM	7.08
36	4:51:00 AM	10:07:00 AM	12:11:00 PM	5.27
37	6:11:00 AM	1:12:00 PM	3:44:00 PM	7.02
38	8:26:00 AM	5:19:00 PM	7:27:00 PM	8.88
39	5:14:00 AM	10:15:0 AM	12:30:00 PM	5.02
40	6:28:00 AM	1:00:00 PM	3:39:00 PM	6.53
41	7:49:00 AM	4:48:00 PM	7:02:00 PM	8.98
42	5:09:00 AM	10:11:00 AM	12:35:00 PM	5.03
43	6:34:00 AM	1:47:00 PM	4:19:00 PM	7.22
44	7:47:00 AM	5:16:00 PM	7:42:00 PM	9.48
45	4:58:00 AM	9:58:00 AM	12:35:00 PM	5.00
46	6:24:00 AM	1:57:00 PM	4:44:00 PM	7.55

Star Wars II

Set#	Deploy Gear	Start Retrieval	End Retrieval	Soak Time (hrs)
1	5:00:00 AM	10:04:00 AM	12:10:00 PM	5.07
2	6:30:00 AM	1:12:00 PM	3:29:00 PM	6.70
3	7:38:00 AM	2:53:00 PM	4:55:00 PM	7.25
4	5:00:00 AM	10:03:00 AM	12:15:00 PM	5.05
5	6:15:00 AM	1:20:00 PM	3:38:00 PM	7.08
6	8:00:00 AM	5:10:00 PM	10:30:00 PM	9.17
7	5:00:00 AM	10:07:00 AM	1:19:00 PM	5.12
8	6:16:00 AM	2:45:00 PM	4:54:00 PM	8.48
9	7:50:00 AM	6:18:00 PM	8:33:00 PM	10.47
10	5:04:00 AM	10:45:00 AM	1:53:00 PM	5.68
11	7:14:00 AM	1:46:00 PM	3:58:00 PM	6.53
12	8:50:00 AM	5:25:00 PM	7:30:00 PM	8.58
13	5:00:00 AM	1:10:00 PM	3:13:00 PM	8.17
14	6:48:00 AM	4:25:00 PM	6:35:00 PM	9.62
15	7:55:00 AM	7:52:00 PM	9:38:00 PM	11.95
16	5:02:00 AM	10:20:00 AM	12:30:00 PM	5.30
17	6:23:00 AM	1:37:00 PM	3:34:00 PM	7.23
18	8:05:00 AM	4:50:00 PM	6:45:00 PM	8.75
19	5:02:00 AM	10:09:00 AM	12:01:00 PM	5.12
20	6:17:00 AM	1:00:00 PM	3:05:00 PM	6.72
21	8:01:00 AM	4:20:00 PM	6:11:00 PM	8.32
22	5:03:00 AM	10:30:00 AM	12:13:00 PM	5.45
23	6:47:00 AM	1:26:00 PM	3:14:00 PM	6.65
24	8:03:00 AM	4:20:00 PM	6:04:00 PM	8.28
25	5:00:00 AM	10:40:00 AM	12:21:00 PM	5.67
26	6:44:00 AM	1:50:00 PM	3:50:00 PM	7.10
27	8:55:00 AM	5:05:00 PM	6:59:00 PM	8.17
28	5:00:00 AM	10:00:00 AM	12:00:00 PM	5.00
29	6:08:00 AM	1:00:00 PM	2:57:00 PM	6.87
30	7:45:00 AM	4:00:00 PM	6:21:00 PM	8.25
31	5:00:00 AM	10:00:00 AM	11:47:00 AM	5.00
32	6:12:00 AM	12:35:00 PM	2:50:00 PM	6.38
33	7:47:00 AM	4:09:00 PM	6:19:00 PM	8.37
34	5:00:00 AM	10:00:00 AM	12:00:00PM	5.00
35	6:10:00 AM	1:04:00 PM	2:55:00 PM	6.90
36	7:50:00 AM	4:00:00 PM	5:48:00 PM	8.17
37	5:02:00 AM	10:15:00 AM	12:35:00 PM	5.22
38	6:48:00 AM	1:45:00 PM	3:59:00 PM	6.95
39	8:25:00 AM	5:06:00 PM	7:18:00 PM	8.68
40	5:00:00 AM	10:30:00 AM	12:35:00 PM	5.50
41	7:36:00 AM	3:07:00 PM	5:16:00 PM	7.52
42	5:00:00 AM	10:31:00 AM	12:15:00 PM	5.52
43	6:14:00 AM	1:15:00 PM	3:33:00 PM	7.02
44	8:02:00 AM	4:43:00 PM	6:54:00 PM	8.68
45	5:00:00 AM	10:00:00 AM	12:15:00 PM	5.00
46	6:38:00 AM	1:37:00 PM	3:40:00 PM	6.98

Appendix Table 3 continued.

Viking Joy

Set#	Deploy Gear	Start Retrieval	End Retrieval	Soak Time (hrs)
47	7:37:00 AM	5:56:00 PM	8:30:00 PM	10.32
48	4:53:00 AM	10:04:00 AM	12:27:00 PM	5.18
49	6:15:00 AM	1:40:00 PM	3:57:00 PM	7.42
50	7:39:00 AM	5:11:00 PM	7:41:00 PM	9.53
51	4:54:00 AM	10:00:00 AM	12:08:00 PM	5.10
52	6:40:00 AM	1:12:00 PM	3:19:00 PM	6.53
53	5:20:00 AM	10:35:00 AM	12:50:00 PM	5.25
54	6:53:00 AM	2:08:00 PM	4:13:00 PM	7.25
55	8:17:00 AM	5:13:00 PM	7:19:00 PM	8.93
56	5:23:00 AM	10:26:00 AM	12:50:00 PM	5.05
57	6:39:00 AM	1:55:00 PM	4:10:00 PM	7.27
58	8:14:00 AM	5:24:00 PM	7:41:00 PM	9.17
59	4:58:00 AM	10:09:00 AM	12:09:00 PM	5.18
60	6:53:00 AM	1:47:00 PM	4:00:00 PM	6.90
61	8:21:00 AM	5:05:00 PM	7:18:00 PM	8.73
62	5:12:00 AM	10:25:00 AM	12:40:00 PM	5.22
63	6:34:00 AM	2:11:00 PM	4:25:00 PM	7.62
64	8:32:00 AM	6:02:00 PM	8:18:00 PM	9.50
65	5:13:00 AM	11:30:00 AM	1:49:00 PM	6.28
66	6:29:00 AM	2:53:00 PM	5:11:00 PM	8.40
67	8:30:00 AM	7:12:00 PM	9:21:00 PM	10.70
68	5:06:00 AM	10:21:00 AM	12:34:00 PM	5.25
69	6:23:00 AM	1:40:00 PM	4:16:00 PM	7.28
70	8:37:00 AM	5:48:00 PM	8:06:00 PM	9.18
71	5:11:00 AM	10:15:00 AM	12:08:00 PM	5.07
72	6:32:00 AM	1:16:00 PM	3:13:00 PM	6.73
73	8:28:00 AM	5:02:00 PM	7:02:00 PM	8.57
74	5:50:00 AM	10:53:00 AM	1:12:00 PM	5.05
75	7:28:00 AM	2:29:00 PM	4:46:00 PM	7.02
76	8:56:00 AM	5:50:00 PM	7:51:00 PM	8.90
77	5:09:00 AM	10:09:00 AM	12:17:00 PM	5.00
78	6:20:00 AM	1:48:00 PM	3:49:00 PM	7.47
79	4:48:00 AM	9:50:00 AM	11:49:00 AM	5.03
80	6:16:00 AM	12:49:00 PM	2:50:00 PM	6.55
81	7:49:00 AM	4:33:00 PM	6:41:00 PM	8.73
82	4:50:00 AM	10:04:00 AM	12:13:00 PM	5.23
83	6:04:00 AM	1:06:00 PM	3:14:00 PM	7.03
84	8:07:00 AM	5:00:00 PM	6:55:00 PM	8.88

Star Wars II

Set#	Deploy Gear	Start Retrieval	End Retrieval	Soak Time (hrs)
47	8:38:00 AM	5:25:00 PM	7:55:00 PM	8.78
48	5:00:00 AM	10:03:00 AM	12:11:00 PM	5.05
49	6:15:00 AM	1:17:00 PM	3:00:00 PM	7.03
50	7:48:00 AM	4:30:00 PM	6:18:00 PM	8.70
51	5:00:00 AM	10:00:00 AM	11:38:00 AM	5.00
52	6:10:00 AM	12:30:00 PM	2:23:00 PM	6.33
53	7:35:00 AM	3:30:00 PM	5:30:00 PM	7.92
54	5:05:00 AM	10:08:00 AM	11:55:00 AM	5.05
55	6:15:00 AM	12:58:00 PM	2:50:00 PM	6.72
56	7:25:00 AM	3:36:00 PM	7:39:00 PM	8.18
57	5:00:00 AM	10:00:00 AM	11:59:00 AM	5.00
58	6:09:00 AM	1:05:00 PM	3:07:00 PM	6.93
59	7:52:00 AM	4:20:00 PM	6:07:00 PM	8.47
60	5:00:00 AM	10:12:00 AM	12:09:00 PM	5.20
61	6:11:00 AM	1:20:00 PM	3:15:00 PM	7.15
62	7:19:00 AM	4:11:00 PM	6:02:00 PM	8.87
63	5:00:00AM	10:00:00 PM	12:00:00 PM	5.00
64	6:13:00 AM	12:58:00 PM	3:00:00 PM	6.75
65	7:40:00 AM	4:20:00 PM	6:15:00 PM	8.67
66	5:05:00 AM	10:15:00 AM	12:01:00 PM	5.17
67	6:49:00 AM	1:15:00 PM	3:15:00 PM	6.43
68	8:07:00 AM	4:05:00 PM	6:25:00 PM	7.97
69	5:00:00 AM	10:04:00 AM	11:58:00 AM	5.07
70	6:34:00 AM	1:06:00 PM	2:53:00 PM	6.53
71	7:44:00 AM	3:45:00 PM	5:25:00 PM	8.02
72	5:00:00 AM	10:03:00 AM	12:02:00 PM	5.05
73	6:15:00 AM	12:55:00 PM	3:15:00 PM	6.67
74	7:44:00 AM	4:20:00 PM	6:29:00 PM	8.60
75	5:00:00 AM	10:00:00 AM	12:05:00 PM	5.00
76	6:12:00 AM	1:10:00 PM	3:14:00 PM	6.97
77	7:44:00 AM	4:26:00 PM	6:50:00 PM	8.70
78	5:00:00 AM	10:17:00 AM	12:16:00 PM	5.28
79	6:38:00 AM	1:30:00 PM	3:31:00 PM	6.87
80	8:16:00 AM	4:47:00 PM	6:46:00 PM	8.52
81	5:01:00 AM	10:20:00 AM	12:43:00 PM	5.32
82	6:43:00 AM	1:50:00 PM	3:52:00 PM	7.12
83	8:15:00 AM	4:50:00 PM	6:40:00 PM	8.58
84	5:00:00 AM	10:02:00 AM	11:57:00 AM	5.03
85	6:12:00 AM	1:02:00 PM	2:41:00 PM	6.83
86	7:46:00 AM	4:00:00 PM	5:50:00 PM	8.23

Appendix Table 4. Summary of biological samples collected onboard the Viking Joy.

Species	Species	Set Number	Sample Type	Date	N
Canary Rockfish	*Sebastes pinniger*	23	L/S/M/O	06-Jun-03	3
China Rockfish	*Sebastes nebulosus*	38	L/S/M/O	21-Jun-03	1
Quillback Rockfish	*Sebastes maliger*	1	L/S/M/O	27-May-03	3
Quillback Rockfish	*Sebastes maliger*	2	L/S/M/O	27-May-03	3
Quillback Rockfish	*Sebastes maliger*	9	L/S/M/O	31-May-03	2
Quillback Rockfish	*Sebastes maliger*	12	L/S/M/O	01-Jun-03	2
Quillback Rockfish	*Sebastes maliger*	24	L/S/M/O	11-Jun-03	4
Quillback Rockfish	*Sebastes maliger*	31	L/S/M/O	17-Jun-03	1
Quillback Rockfish	*Sebastes maliger*	33	L/S/M/O	17-Jun-03	1
Quillback Rockfish	*Sebastes maliger*	36	L/S/M/O	21-Jun-03	1
Quillback Rockfish	*Sebastes maliger*	38	L/S/M/O	21-Jun-03	1
Quillback Rockfish	*Sebastes maliger*	39	L/S/M/O	22-Jun-03	11
Quillback Rockfish	*Sebastes maliger*	41	L/S/M/O	22-Jun-03	10
Quillback Rockfish	*Sebastes maliger*	51	L/S/M/O	26-Jun-03	2
Quillback Rockfish	*Sebastes maliger*	52	L/S/M/O	26-Jun-03	2
Quillback Rockfish	*Sebastes maliger*	66	L/S/M/O	03-Jul-03	2
Quillback Rockfish	*Sebastes maliger*	73	L/S/M/O	05-Jul-03	3
Quillback Rockfish	*Sebastes maliger*	74	L/S/M/O	08-Jul-03	2
Quillback Rockfish	*Sebastes maliger*	75	L/S/M/O	08-Jul-03	3
Redbanded Rockfish	*Sebastes babcocki*	6	L/S/M/O	29-May-03	3
Redbanded Rockfish	*Sebastes babcocki*	19	L/S/M/O	05-Jun-03	2
Redbanded Rockfish	*Sebastes babcocki*	30	L/S/M/O	16-Jun-03	9
Redbanded Rockfish	*Sebastes babcocki*	32	L/S/M/O	17-Jun-03	23
Redbanded Rockfish	*Sebastes babcocki*	34	L/S/M/O	20-Jun-03	2
Redbanded Rockfish	*Sebastes babcocki*	35	L/S/M/O	20-Jun-03	8
Redbanded Rockfish	*Sebastes babcocki*	37	L/S/M/O	21-Jun-03	8
Redbanded Rockfish	*Sebastes babcocki*	44	L/S/M/O	23-Jun-03	10
Redbanded Rockfish	*Sebastes babcocki*	45	L/S/M/O	24-Jun-03	21
Redbanded Rockfish	*Sebastes babcocki*	47	L/S/M/O	24-Jun-03	14
Redbanded Rockfish	*Sebastes babcocki*	48	L/S/M/O	25-Jun-03	1
Redbanded Rockfish	*Sebastes babcocki*	50	L/S/M/O	25-Jun-03	20
Redbanded Rockfish	*Sebastes babcocki*	56	L/S/M/O	30-Jun-03	1
Redbanded Rockfish	*Sebastes babcocki*	58	L/S/M/O	30-Jun-03	1
Redbanded Rockfish	*Sebastes babcocki*	62	L/S/M/O	02-Jul-03	19
Redbanded Rockfish	*Sebastes babcocki*	64	L/S/M/O	02-Jul-03	2
Redbanded Rockfish	*Sebastes babcocki*	69	L/S/M/O	04-Jul-03	13
Redbanded Rockfish	*Sebastes babcocki*	70	L/S/M/O	04-Jul-03	12
Redbanded Rockfish	*Sebastes babcocki*	72	L/S/M/O	05-Jul-03	1
Redbanded Rockfish	*Sebastes babcocki*	77	L/S/M/O	09-Jul-03	1
Redbanded Rockfish	*Sebastes babcocki*	78	L/S/M/O	09-Jul-03	3
Redbanded Rockfish	*Sebastes babcocki*	82	L/S/M/O	11-Jul-03	16
Redbanded Rockfish	*Sebastes babcocki*	83	L/S/M/O	11-Jul-03	9
Rougheye Rockfish	*Sebastes aleutianus*	62	L/S/M/O	02-Jul-03	43
Rougheye Rockfish	*Sebastes aleutianus*	64	L/S/M/O	02-Jul-03	1
Rougheye Rockfish	*Sebastes aleutianus*	70	L/S/M/O	04-Jul-03	2
Sablefish	*Anoplopoma fimbria*	2	L/S	27-May-03	1
Sablefish	*Anoplopoma fimbria*	5	L/S	28-May-03	1

Appendix Table 4 continued

Species	Species	Set Number	Sample Type	Date	N
Sablefish	*Anoplopoma fimbria*	6	L/S/M/O	29-May-03	50
Sablefish	*Anoplopoma fimbria*	7	L/S/M/O	29-May-03	50
Sablefish	*Anoplopoma fimbria*	16	L/S/M/O	04-Jun-03	42
Sablefish	*Anoplopoma fimbria*	19	L/S/M/O	05-Jun-03	50
Sablefish	*Anoplopoma fimbria*	20	L/S/M	05-Jun-03	5
Sablefish	*Anoplopoma fimbria*	25	L/S/M	11-Jun-03	1
Sablefish	*Anoplopoma fimbria*	27	L/S/M/O	15-Jun-03	50
Sablefish	*Anoplopoma fimbria*	29	L/S/M	16-Jun-03	1
Sablefish	*Anoplopoma fimbria*	30	L/S/M/O	16-Jun-03	48
Sablefish	*Anoplopoma fimbria*	32	L/S/M	17-Jun-03	8
Sablefish	*Anoplopoma fimbria*	34	L/S/M	20-Jun-03	9
Sablefish	*Anoplopoma fimbria*	35	L/S/M/O	20-Jun-03	28
Sablefish	*Anoplopoma fimbria*	37	L/S/M	21-Jun-03	6
Sablefish	*Anoplopoma fimbria*	43	L/S/M	23-Jun-03	19
Sablefish	*Anoplopoma fimbria*	44	L/S/M/O	23-Jun-03	30
Sablefish	*Anoplopoma fimbria*	45	L/S/M/O	24-Jun-03	50
Sablefish	*Anoplopoma fimbria*	46	L/S/M/O	24-Jun-03	50
Sablefish	*Anoplopoma fimbria*	47	L/S/M/O	24-Jun-03	29
Sablefish	*Anoplopoma fimbria*	48	L/S/M/O	25-Jun-03	50
Sablefish	*Anoplopoma fimbria*	49	L/S/M	25-Jun-03	48
Sablefish	*Anoplopoma fimbria*	50	L/S/M/O	25-Jun-03	50
Sablefish	*Anoplopoma fimbria*	52	L/S/M	26-Jun-03	17
Sablefish	*Anoplopoma fimbria*	53	L/S/M/O	29-Jun-03	31
Sablefish	*Anoplopoma fimbria*	56	L/S/M	30-Jun-03	1
Sablefish	*Anoplopoma fimbria*	58	L/S/M	30-Jun-03	50
Sablefish	*Anoplopoma fimbria*	62	L/S/M/O	02-Jul-03	43
Sablefish	*Anoplopoma fimbria*	63	L/S/M	02-Jul-03	1
Sablefish	*Anoplopoma fimbria*	64	L/S/M/O	02-Jul-03	22
Sablefish	*Anoplopoma fimbria*	69	L/S/M/O	04-Jul-03	20
Sablefish	*Anoplopoma fimbria*	70	L/S/M	04-Jul-03	15
Sablefish	*Anoplopoma fimbria*	74	L/S/M	08-Jul-03	1
Sablefish	*Anoplopoma fimbria*	77	L/S/M	09-Jul-03	3
Sablefish	*Anoplopoma fimbria*	78	L/S/M	09-Jul-03	5
Sablefish	*Anoplopoma fimbria*	79	L/S/M	10-Jul-03	12
Sablefish	*Anoplopoma fimbria*	80	L/S/M	10-Apr-03	3
Sablefish	*Anoplopoma fimbria*	82	L/S/M	11-Jul-03	4
Sablefish	*Anoplopoma fimbria*	83	L/S/M	11-Jul-03	7
Sablefish	*Anoplopoma fimbria*	84	L/S/M	11-Jul-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	1	L/S/M/O	27-May-03	6
Yelloweye Rockfish	*Sebastes ruberrimus*	8	L/S/M/O	29-May-03	24
Yelloweye Rockfish	*Sebastes ruberrimus*	9	L/S/M/O	31-May-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	12	L/S/M/O	01-Jun-03	11
Yelloweye Rockfish	*Sebastes ruberrimus*	23	L/S/M/O	06-Jun-03	13
Yelloweye Rockfish	*Sebastes ruberrimus*	27	L/S/M/O	15-Jun-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	32	L/S/M/O	17-Jun-03	4
Yelloweye Rockfish	*Sebastes ruberrimus*	33	L/S/M/O	17-Jun-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	34	L/S/M/O	20-Jun-03	18
Yelloweye Rockfish	*Sebastes ruberrimus*	35	L/S/M/O	20-Jun-03	10

Appendix Table 4 continued

Species	Species	Set Number	Sample Type	Date	N
Yelloweye Rockfish	*Sebastes ruberrimus*	36	L/S/M/O	21-Jun-03	3
Yelloweye Rockfish	*Sebastes ruberrimus*	37	L/S/M/O	21-Jun-03	6
Yelloweye Rockfish	*Sebastes ruberrimus*	38	L/S/M/O	21-Jun-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	39	L/S/M/O	22-Jun-03	4
Yelloweye Rockfish	*Sebastes ruberrimus*	41	L/S/M/O	22-Jun-03	41
Yelloweye Rockfish	*Sebastes ruberrimus*	42	L/S/M/O	23-Jun-03	3
Yelloweye Rockfish	*Sebastes ruberrimus*	44	L/S/M/O	23-Jun-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	47	L/S/M/O	24-Jun-03	6
Yelloweye Rockfish	*Sebastes ruberrimus*	49	L/S/M/O	25-Jun-03	50
Yelloweye Rockfish	*Sebastes ruberrimus*	50	L/S/M/O	25-Jun-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	51	L/S/M/O	26-Jun-03	2
Yelloweye Rockfish	*Sebastes ruberrimus*	52	L/S/M/O	26-Jun-03	7
Yelloweye Rockfish	*Sebastes ruberrimus*	55	L/S/M/O	29-Jun-03	9
Yelloweye Rockfish	*Sebastes ruberrimus*	61	L/S/M/O	01-Jul-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	65	L/S/M/O	03-Jul-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	66	L/S/M/O	03-Jul-03	49
Yelloweye Rockfish	*Sebastes ruberrimus*	68	L/S/M/O	04-Jul-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	69	L/S/M/O	04-Jul-03	5
Yelloweye Rockfish	*Sebastes ruberrimus*	73	L/S/M/O	05-Jul-03	42
Yelloweye Rockfish	*Sebastes ruberrimus*	74	L/S/M/O	08-Jul-03	3
Yelloweye Rockfish	*Sebastes ruberrimus*	75	L/S/M/O	08-Jul-03	10
Yelloweye Rockfish	*Sebastes ruberrimus*	77	L/S/M/O	09-Jul-03	3
Yelloweye Rockfish	*Sebastes ruberrimus*	84	L/S/M/O	11-Jul-03	3

Appendix Table 5. Summary of biological samples collected onboard the Star Wars II.

Species	Species	Set Number	Sample Type	Date	N
Bocaccio Rockfish	*Sebastes paucispinus*	39	L/S/M/O	22-Jul-03	3
Bocaccio Rockfish	*Sebastes paucispinus*	41	L/S/M/O	23-Jul-03	1
Quillback Rockfish	*Sebastes maliger*	13	L/S/M/O	09-Jul-03	7
Quillback Rockfish	*Sebastes maliger*	25	L/S/M/O	15-Jul-03	2
Quillback Rockfish	*Sebastes maliger*	36	L/S/M/O	18-Jul-03	2
Quillback Rockfish	*Sebastes maliger*	41	L/S/M/O	23-Jul-03	9
Quillback Rockfish	*Sebastes maliger*	54	L/S/M/O	30-Jul-03	1
Quillback Rockfish	*Sebastes maliger*	55	L/S/M/O	30-Jul-03	6
Quillback Rockfish	*Sebastes maliger*	56	L/S/M/O	30-Jul-03	1
Quillback Rockfish	*Sebastes maliger*	64	L/S/M/O	02-Aug-03	11
Quillback Rockfish	*Sebastes maliger*	65	L/S/M/O	02-Aug-03	4
Quillback Rockfish	*Sebastes maliger*	69	L/S/M/O	04-Aug-03	3
Quillback Rockfish	*Sebastes maliger*	83	L/S/M/O	10-Aug-03	16
Redbanded Rockfish	*Sebastes babcocki*	1	L/S/M/O	05-Jul-03	4
Redbanded Rockfish	*Sebastes babcocki*	2	L/S/M/O	05-Jul-03	7
Redbanded Rockfish	*Sebastes babcocki*	3	L/S/M/O	05-Jul-03	11
Redbanded Rockfish	*Sebastes babcocki*	4	L/S/M/O	06-Jul-03	39
Redbanded Rockfish	*Sebastes babcocki*	5	L/S/M/O	06-Jul-03	10
Redbanded Rockfish	*Sebastes babcocki*	8	L/S/M/O	07-Jul-03	1
Redbanded Rockfish	*Sebastes babcocki*	9	L/S/M/O	07-Jul-03	5
Redbanded Rockfish	*Sebastes babcocki*	10	L/S/M/O	08-Jul-03	3
Redbanded Rockfish	*Sebastes babcocki*	12	L/S/M/O	08-Jul-03	11
Redbanded Rockfish	*Sebastes babcocki*	16	L/S/M/O	10-Jul-03	7
Redbanded Rockfish	*Sebastes babcocki*	19	L/S/M/O	13-Jul-03	15
Redbanded Rockfish	*Sebastes babcocki*	20	L/S/M/O	13-Jul-03	52
Redbanded Rockfish	*Sebastes babcocki*	27	L/S/M/O	15-Jul-03	1
Redbanded Rockfish	*Sebastes babcocki*	28	L/S/M/O	16-Jul-03	14
Redbanded Rockfish	*Sebastes babcocki*	29	L/S/M/O	16-Jul-03	10
Redbanded Rockfish	*Sebastes babcocki*	30	L/S/M/O	16-Jul-03	18
Redbanded Rockfish	*Sebastes babcocki*	31	L/S/M/O	17-Jul-03	25
Redbanded Rockfish	*Sebastes babcocki*	32	L/S/M/O	17-Jul-03	17
Redbanded Rockfish	*Sebastes babcocki*	33	L/S/M/O	17-Jul-03	10
Redbanded Rockfish	*Sebastes babcocki*	34	L/S/M/O	18-Jul-03	47
Redbanded Rockfish	*Sebastes babcocki*	35	L/S/M/O	18-Jul-03	50
Redbanded Rockfish	*Sebastes babcocki*	36	L/S/M/O	18-Jul-03	43
Redbanded Rockfish	*Sebastes babcocki*	37	L/S/M/O	22-Jul-03	15
Redbanded Rockfish	*Sebastes babcocki*	45	L/S/M/O	25-Jul-03	49
Redbanded Rockfish	*Sebastes babcocki*	52	L/S/M/O	27-Jul-03	8
Redbanded Rockfish	*Sebastes babcocki*	61	L/S/M/O	01-Aug-03	8
Redbanded Rockfish	*Sebastes babcocki*	63	L/S/M/O	02-Aug-03	15
Redbanded Rockfish	*Sebastes babcocki*	66	L/S/M/O	03-Aug-03	11
Redbanded Rockfish	*Sebastes babcocki*	67	L/S/M/O	03-Aug-03	4
Redbanded Rockfish	*Sebastes babcocki*	69	L/S/M/O	04-Aug-03	3
Redbanded Rockfish	*Sebastes babcocki*	72	L/S/M/O	07-Aug-03	6
Redbanded Rockfish	*Sebastes babcocki*	73	L/S/M/O	07-Aug-03	8
Redbanded Rockfish	*Sebastes babcocki*	74	L/S/M/O	07-Aug-03	30
Redbanded Rockfish	*Sebastes babcocki*	79	L/S/M/O	09-Aug-03	2
Redbanded Rockfish	*Sebastes babcocki*	80	L/S/M/O	09-Aug-03	2
Redbanded Rockfish	*Sebastes babcocki*	81	L/S/M/O	10-Aug-03	46
Redbanded Rockfish	*Sebastes babcocki*	82	L/S/M/O	10-Aug-03	28
Redbanded Rockfish	*Sebastes babcocki*	84	L/S/M/O	11-Aug-03	29

Appendix Table 5 continued

Species	Species	Set Number	Sample Type	Date	N
Rougheye Rockfish	*Sebastes aleutianus*	11	L/S/M/O	08-Jul-03	3
Rougheye Rockfish	*Sebastes aleutianus*	37	L/S/M/O	22-Jul-03	45
Rougheye Rockfish	*Sebastes aleutianus*	47	L/S/M/O	25-Jul-03	50
Shortraker Rockfish	*Sebastes borealis*	37	L/S/M/O	22-Jul-03	15
Sablefish	*Anoplopoma fimbria*	1	L/S/M/O	05-Jul-03	23
Sablefish	*Anoplopoma fimbria*	2	L/S/M/O	05-Jul-03	12
Sablefish	*Anoplopoma fimbria*	3	L/S/M/O	05-Jul-03	45
Sablefish	*Anoplopoma fimbria*	10	L/S/M/O	08-Jul-03	45
Sablefish	*Anoplopoma fimbria*	11	L/S/M/O	08-Jul-03	49
Sablefish	*Anoplopoma fimbria*	34	L/S/M/O	18-Jul-03	40
Sablefish	*Anoplopoma fimbria*	38	L/S/M/O	22-Jul-03	46
Sablefish	*Anoplopoma fimbria*	43	L/S/M/O	24-Jul-03	48
Sablefish	*Anoplopoma fimbria*	44	L/S/M/O	24-Jul-03	27
Sablefish	*Anoplopoma fimbria*	47	L/S/M/O	25-Jul-03	47
Sablefish	*Anoplopoma fimbria*	48	L/S/M/O	26-Jul-03	48
Sablefish	*Anoplopoma fimbria*	52	L/S/M/O	27-Jul-03	47
Sablefish	*Anoplopoma fimbria*	53	L/S/M/O	27-Jul-03	47
Sablefish	*Anoplopoma fimbria*	54	L/S/M/O	30-Jul-03	46
Sablefish	*Anoplopoma fimbria*	55	L/S/M/O	30-Jul-03	18
Sablefish	*Anoplopoma fimbria*	56	L/S/M/O	30-Jul-03	32
Sablefish	*Anoplopoma fimbria*	57	L/S/M/O	31-Jul-03	17
Sablefish	*Anoplopoma fimbria*	61	L/S/M/O	01-Aug-03	3
Sablefish	*Anoplopoma fimbria*	63	L/S/M/O	02-Aug-03	11
Sablefish	*Anoplopoma fimbria*	66	L/S/M/O	03-Aug-03	44
Sablefish	*Anoplopoma fimbria*	67	L/S/M/O	03-Aug-03	21
Sablefish	*Anoplopoma fimbria*	68	L/S/M/O	03-Aug-03	50
Sablefish	*Anoplopoma fimbria*	69	L/S/M/O	04-Aug-03	13
Sablefish	*Anoplopoma fimbria*	70	L/S/M/O	04-Aug-03	20
Sablefish	*Anoplopoma fimbria*	72	L/S/M/O	07-Aug-03	34
Sablefish	*Anoplopoma fimbria*	73	L/S/M/O	07-Aug-03	48
Sablefish	*Anoplopoma fimbria*	74	L/S/M/O	07-Aug-03	5
Sablefish	*Anoplopoma fimbria*	78	L/S/M/O	09-Aug-03	48
Sablefish	*Anoplopoma fimbria*	79	L/S/M/O	09-Aug-03	29
Sablefish	*Anoplopoma fimbria*	80	L/S/M/O	09-Aug-03	7
Sablefish	*Anoplopoma fimbria*	82	L/S/M/O	10-Aug-03	5
Sablefish	*Anoplopoma fimbria*	85	L/S/M/O	11-Aug-03	6
Sablefish	*Anoplopoma fimbria*	1	L/S/M	05-Jul-03	9
Sablefish	*Anoplopoma fimbria*	4	L/S/M	06-Jul-03	48
Sablefish	*Anoplopoma fimbria*	6	L/S/M	06-Jul-03	9
Sablefish	*Anoplopoma fimbria*	9	L/S/M	07-Jul-03	16
Sablefish	*Anoplopoma fimbria*	12	L/S/M	08-Jul-03	13
Sablefish	*Anoplopoma fimbria*	16	L/S/M	10-Jul-03	12
Sablefish	*Anoplopoma fimbria*	18	L/S/M	10-Jul-03	5
Sablefish	*Anoplopoma fimbria*	20	L/S/M	13-Jul-03	15
Sablefish	*Anoplopoma fimbria*	28	L/S/M	16-Jul-03	21
Sablefish	*Anoplopoma fimbria*	29	L/S/M	16-Jul-03	20
Sablefish	*Anoplopoma fimbria*	30	L/S/M	16-Jul-03	50
Sablefish	*Anoplopoma fimbria*	31	L/S/M	17-Jul-03	5
Sablefish	*Anoplopoma fimbria*	32	L/S/M	17-Jul-03	7
Sablefish	*Anoplopoma fimbria*	33	L/S/M	17-Jul-03	17
Sablefish	*Anoplopoma fimbria*	46	L/S/M	25-Jul-03	29
Sablefish	*Anoplopoma fimbria*	78	L/S	09-Aug-03	23

Appendix Table 5 continued

Species	Species	Set Number	Sample Type	Date	N
Silvergray Rockfish	*Sebastes brevispinus*	39	L/S/M/O	22-Jul-03	11
Silvergray Rockfish	*Sebastes brevispinus*	40	L/S/M/O	23-Jul-03	3
Silvergray Rockfish	*Sebastes brevispinus*	41	L/S/M/O	23-Jul-03	5
Silvergray Rockfish	*Sebastes brevispinus*	46	L/S/M/O	25-Jul-03	2
Yelloweye Rockfish	*Sebastes ruberrimus*	2	L/S/M/O	05-Jul-03	17
Yelloweye Rockfish	*Sebastes ruberrimus*	5	L/S/M/O	06-Jul-03	20
Yelloweye Rockfish	*Sebastes ruberrimus*	7	L/S/M/O	07-Jul-03	44
Yelloweye Rockfish	*Sebastes ruberrimus*	8	L/S/M/O	07-Jul-03	8
Yelloweye Rockfish	*Sebastes ruberrimus*	12	L/S/M/O	08-Jul-03	7
Yelloweye Rockfish	*Sebastes ruberrimus*	13	L/S/M/O	09-Jul-03	5
Yelloweye Rockfish	*Sebastes ruberrimus*	18	L/S/M/O	10-Jul-03	6
Yelloweye Rockfish	*Sebastes ruberrimus*	19	L/S/M/O	13-Jul-03	6
Yelloweye Rockfish	*Sebastes ruberrimus*	22	L/S/M/O	14-Jul-03	20
Yelloweye Rockfish	*Sebastes ruberrimus*	25	L/S/M/O	15-Jul-03	2
Yelloweye Rockfish	*Sebastes ruberrimus*	26	L/S/M/O	15-Jul-03	52
Yelloweye Rockfish	*Sebastes ruberrimus*	27	L/S/M/O	15-Jul-03	16
Yelloweye Rockfish	*Sebastes ruberrimus*	31	L/S/M/O	17-Jul-03	4
Yelloweye Rockfish	*Sebastes ruberrimus*	32	L/S/M/O	17-Jul-03	28
Yelloweye Rockfish	*Sebastes ruberrimus*	35	L/S/M/O	18-Jul-03	6
Yelloweye Rockfish	*Sebastes ruberrimus*	36	L/S/M/O	18-Jul-03	11
Yelloweye Rockfish	*Sebastes ruberrimus*	39	L/S/M/O	22-Jul-03	13
Yelloweye Rockfish	*Sebastes ruberrimus*	40	L/S/M/O	23-Jul-03	34
Yelloweye Rockfish	*Sebastes ruberrimus*	41	L/S/M/O	23-Jul-03	34
Yelloweye Rockfish	*Sebastes ruberrimus*	42	L/S/M/O	24-Jul-03	10
Yelloweye Rockfish	*Sebastes ruberrimus*	54	L/S/M/O	30-Jul-03	7
Yelloweye Rockfish	*Sebastes ruberrimus*	56	L/S/M/O	30-Jul-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	61	L/S/M/O	01-Aug-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	63	L/S/M/O	02-Aug-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	64	L/S/M/O	02-Aug-03	10
Yelloweye Rockfish	*Sebastes ruberrimus*	65	L/S/M/O	02-Aug-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	69	L/S/M/O	04-Aug-03	28
Yelloweye Rockfish	*Sebastes ruberrimus*	77	L/S/M/O	08-Aug-03	41
Yelloweye Rockfish	*Sebastes ruberrimus*	78	L/S/M/O	09-Aug-03	13
Yelloweye Rockfish	*Sebastes ruberrimus*	79	L/S/M/O	09-Aug-03	1
Yelloweye Rockfish	*Sebastes ruberrimus*	83	L/S/M/O	10-Aug-03	7
Yelloweye Rockfish	*Sebastes ruberrimus*	84	L/S/M/O	11-Aug-03	2
Yelloweye Rockfish	*Sebastes ruberrimus*	86	L/S/M/O	11-Aug-03	41